

1.5V STEREO HEADPHONE AMPLIFIER

The KIA8159FN is developed for play-back stereo headphone equipments (1.5V use). It is built in dual auto-reverse pre amplifiers, dual OCL power amplifiers, and a ripple filter.

FEATURES

Power Amp. Stage

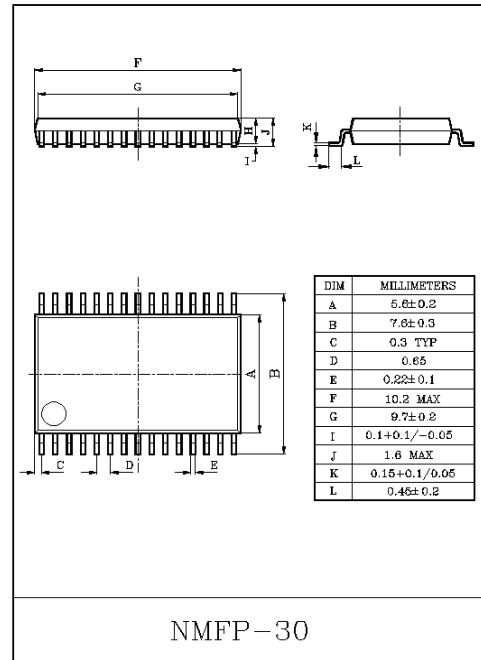
- OCL (Output Condenser Less)
- Low Noise : $V_{no}=48\mu V_{rms}$ (Typ.)
- Output Power : $PO=6mW$ (Typ.)
(at $V_{CC}=1.5V$, $f=1kHz$, $THD=10\%$)
- Excellent ripple rejection ratio : $RR=54dB$ (Typ.)
- Voltage Gain : $G_V=28dB$ (Typ.)
- Built-in power amplifier mute.

Pre-Amp. Stage

- Auto-reverse with F/R control switch
- Low Noise : $V_{no}=1.7\mu V_{rms}$ (Typ.)
- Input coupling condenser-less
- Built-in input capacitor for reducing buzz noise
- Built-in pre-amplifier mute

TOTAL

- Built-in ripple filter
- Built-in ower switch
- Operating supply voltage range : $V_{CC(opr)}=0.9V\sim 2.2V$ (Typ.)



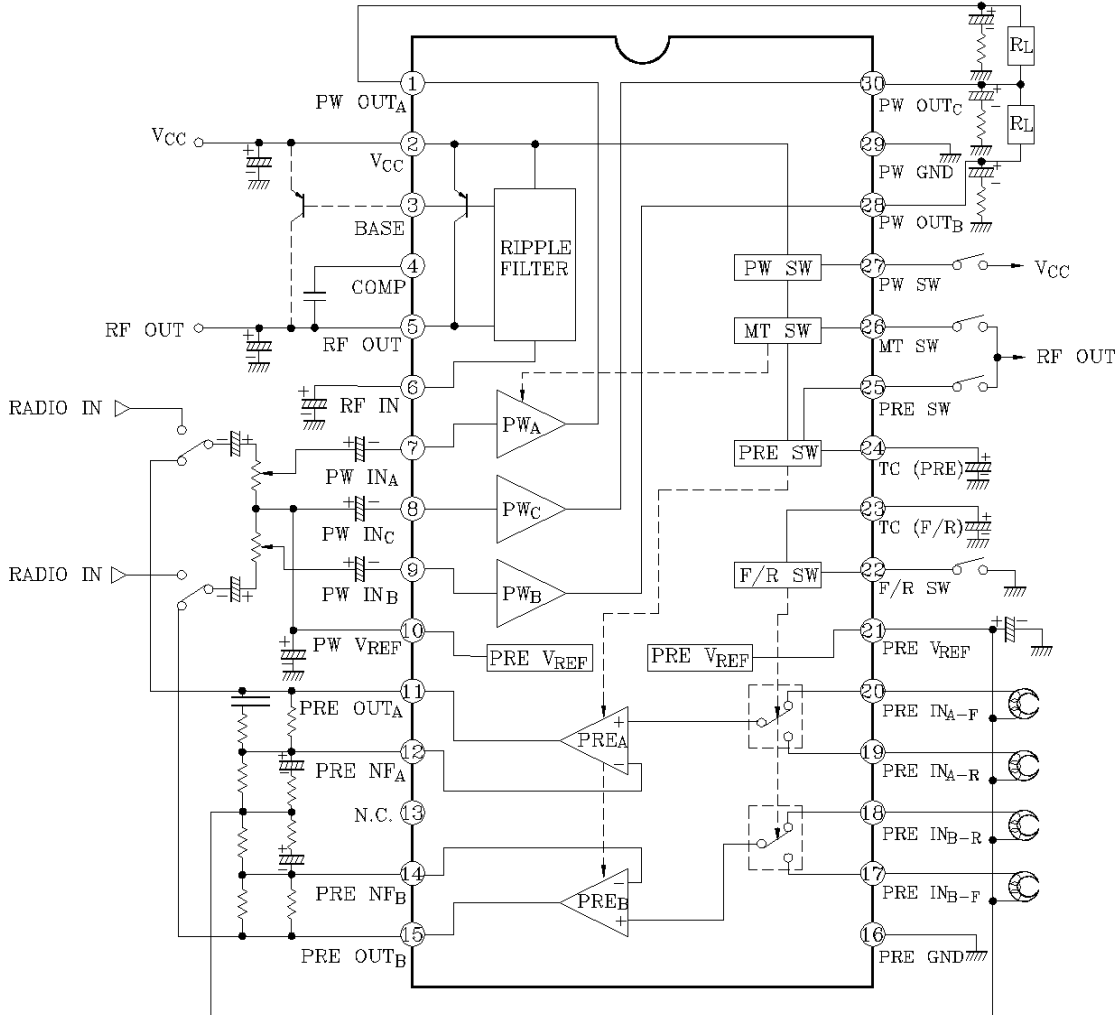
MAXIMUM RATINGS (Ta=25°C)

| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|-----------------------|---------------|---------------|---------|------|
| Supply Voltage | | V_{CC} | 3 | V |
| Output Current | Power | $I_{O(peak)}$ | 60 | mA |
| | Ripple Filter | I_{RF} | 5 | |
| Power Dissipation | | P_D (Note) | 550 | mW |
| Operating Temperature | | T_{opr} | -25~75 | °C |
| Storage Temperature | | T_{stg} | -55~150 | °C |

Note) Derated above $T_a=25^\circ C$ in the proportion of $4.4mW/^\circ C$ for KIA8159FN.

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BLOCK DIAGRAM



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ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, $V_{CC}=1.2V$, $f=1kHz$, $T_a=25^{\circ}C$ $SW_1 : a$, $SW_2 : a$, $SW_3 : a$, $SW_7 : on$,
 Power-amplifier stage : $R_g=600\Omega$, $R_L=16\Omega$, $SW_3 : b$, $SW_6 : a$,
 Power-amplifierstage : $R_g=2.2k\Omega$, $R_L=10k\Omega$, $SW_2 : b$, $SW_5 : a$,

| CHARACTERISTIC | | SYMBOL | TEST CIRCUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------------------|--------------------------------|---|---------------|---|------|------|------|---------------|
| Quiescent Current | | I_{CCQ1} | 1 | POWER OFF, $SW_1:b$, $SW_2:b$ | - | 0.1 | 5 | μA |
| | | I_{CCQ2} | | POWER Amp. OFF, $SW_2:b$ | - | 2.8 | 4.5 | mA |
| | | I_{CCQ3} | | $V_{IN}=0$ | - | 13 | 16 | |
| Power-amplifier Stage | Voltage Gain | G_V | 2 | $V_O=-22dBV$ | 26 | 28 | 30 | dB |
| | Channel Balance | CB | | | - | 0 | 1.5 | |
| | Output Power | P_O | | $V_{CC}=1.5V$, $V_{IN(A)}=V_{IN(B)}$ THD=10% | 5 | 6 | - | mW |
| | Total Harmonic Distortion | THD ₁ | | $V_{CC}=1V$, $P_O(A)=P_O(B)=1mW$ | - | 0.4 | 1.5 | % |
| | Output Noise Voltage | V_{NO} | | BPF:20Hz~20kHz, $SW_6:b$ | - | 48 | 70 | μV_{rms} |
| | Ripple Rejection Ratio | RR ₁ | | $V_{CC}=1V$, $f_r=100Hz$, $V_r=-32dBV$ $I_{RF}=0$, $SW_6:b$, $SW_7:open$ | 45 | 54 | - | dB |
| | Cross Talk (CH-A/CH-B) | CT ₁ | | $V_O=-22dBV$ | 30 | 38 | - | |
| Power Muting Attenuation | ATT ₁ | $V_O=-22dBV$, $SW_2 : a \rightarrow b$ | 70 | 83 | - | | | |
| Ripple Filter Stage | Output Voltage | V_{RF} | 2 | $V_{CC}=1V$, $I_{RF}=0$ | 0.88 | 0.92 | - | V |
| | Ripple Rejection Ratio | RR ₂ | | $V_{CC}=1V$, $f_r=100Hz$, $V_r=-32dBV$ $I_{RF}=30mA$, $SW_7:open$ | 38 | 45 | - | dB |
| Play Amp. | Open Loop Voltage Gain | G_{VO} | 2 | $V_O=-22dBm$, $SW_5:b$ | 63 | 70 | - | dB |
| | Closed Loop Voltage Gain | G_{VC} | | | - | 34 | - | |
| | Maximum Output Voltage | V_{OM} | | THD=1% | 160 | 290 | - | mV_{rms} |
| | Total Harmonic Distortion | THD ₂ | | $V_{CC}=1V$, $V_O=100mV_{rms}$ | - | 0.06 | 0.3 | % |
| | Equivalent Input Noise Voltage | V_{NI} | | BPF:20Hz~20kHz $SW_8:open$ NAB ($f=1kHz$, $G_V=34dB$) | - | 1.7 | 2.7 | μV_{rms} |
| | Cross Talk (CH-A/CH-B) | CT ₂ | | $V_O=-22dBm$ | - | 61 | - | dB |
| | Cross Talk (Forward/Reverse) | CT ₃ | | | - | 61 | - | |
| Pre Muting Attenuation | ATT ₂ | $V_O=-22dBV$, $SW_3:a \rightarrow b$ | - | 75 | - | | | |
| Power ON Current | I_{27} | 1 | $V_{CC}=0.9V$ | $V_{10} \geq 0.5V$, $SW_1:c$ | 5 | - | - | μA |
| Power OFF Voltage | V_{27} | | | $V_{10} \leq 0.3V$, $SW_1:d$ | 0 | - | 0.3 | V |
| Power Amp. Mute OFF Current | I_{26} | | | $V_{30} \geq 0.4V$, $SW_2:c$ | 5 | - | - | μA |
| Power Amp. Mute ON Current | V_{26} | | | $V_{30} \leq 0.3V$, $SW_2:d$ | 0 | - | 0.3 | V |
| Pre Amp. ON Current | I_{25} | | | $V_{24} \geq 0.5V$, $SW_3:c$ | 5 | - | - | μA |
| Pre Amp. OFF Voltage | V_{25} | | | $V_{24} \leq 0.3V$, $SW_3:d$ | 0 | - | 0.3 | V |
| Reverse Mode Voltage | V_{22} | | | $V_{23} \geq 0.5V$, $SW_4:c$ | 0 | - | 0.3 | V |
| | | | | | | | | |

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EXPLANATION OF TERMINALS

(Terminal Voltage : Typical terminal voltage at no signal with test circuit $V_{CC}=1.2V$, $T_a=25^{\circ}C$)

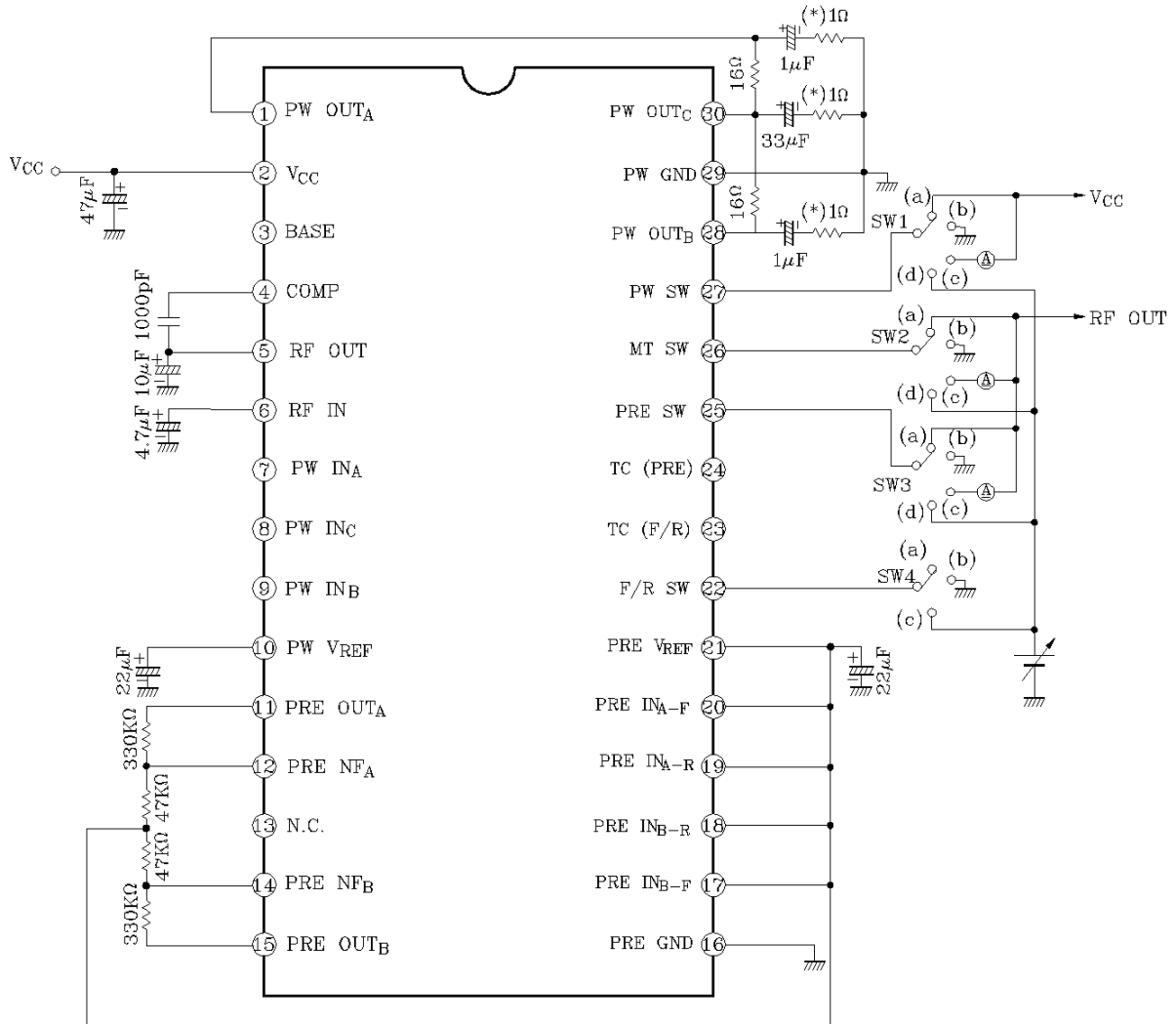
| PIN NO. | TERMINAL NAME | FUNCTION | INTERNAL CIRCUIT | TERMINAL VOLTAGE(V) | | |
|---------|---------------------|---|------------------|---------------------|------|------|
| 1 | PW OUT _A | Output of power amplifier. | | 0.6 | | |
| 28 | PW OUT _B | | | 0.6 | | |
| 30 | PW OUT _C | Output of common power amplifier. | | 0.6 | | |
| 7 | PW IN _A | Input of power amplifier. | | | 0.75 | |
| 9 | PW IN _B | | | | 0.75 | |
| 8 | PW IN _C | Input of common power Amplifier. | | | 0.75 | |
| 2 | V _{CC} | - | | | | 1.2 |
| 3 | BASE | Base bias of an external PNP transistor for ripple filter. | | | | 0.5 |
| 4 | COMP | Phase compensation of ripple filter circuit. | | | | 0.5 |
| 5 | RF OUT | Ripple filter output. Ripple filter circuit supplies V _{REF} circuit, Pre-amplifier circuit, and F/R switch circuit with power source. | | | | 1.13 |
| 6 | RF IN | Ripple filter terminal. | 1.13 | | | |
| 10 | PW V _{REF} | Reference voltage of power amplifier. | | | 0.75 | |

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| PIN NO. | TERMINAL NAME | FUNCTION | INTERNAL EQUIVALENT CIRCUIT | TERMINAL VOLTAGE(V) |
|---------|-----------------------|--|-----------------------------|---------------------|
| 11 | PRE OUT _A | Output of pre-amplifier. | | 0.5 |
| 15 | PRE OUT _B | | | |
| 12 | PRE NF _A | NF of pre-amplifier. | | 0.75 |
| 14 | PRE NF _B | | | |
| 17 | PRE IN _{B-F} | Forward input of pre-amplifier. (at F/R SW : open) | | 0.75 |
| 20 | PRE IN _{A-F} | | | |
| 18 | PRE IN _{B-R} | Reverse input of pre-amplifier. (at F/R SW : GND) | | 0.75 |
| 19 | PRE IN _{A-R} | | | |
| 13 | NC | - | - | - |
| 16 | PRE GND | - | - | 0 |
| 21 | PRE V _{REF} | Reference voltage of pre-amplifier. | | 0.75 |
| 22 | F/R SW | Forward/Reverse mode switch. · OPEN : Forward mode. · GND : Reverse mode. | | - |
| 23 | TC (F/R) | Smoothing terminal. In order to reduce a pop noise at F/R switching. | | 0.7 |
| 24 | TC (PRE) | Smoothing terminal. In order to reduce a pop noise at Pre-amplifier ON/OFF switching. | | 0.7 |
| 25 | PRE SW | Pre-amplifier ON/OFF switch. · RF OUT : ON · GND/OPEN : OFF | | - |
| 26 | MT SW | Muting switch for power amplifier · RF OUT : MUTE OFF · GND/OPEN : MUTE ON | | - |
| 27 | PW SW | Power ON/OFF switch. · VCC : ON · GND/OPEN : OFF | | - |
| 29 | PW GND | - | - | 0 |

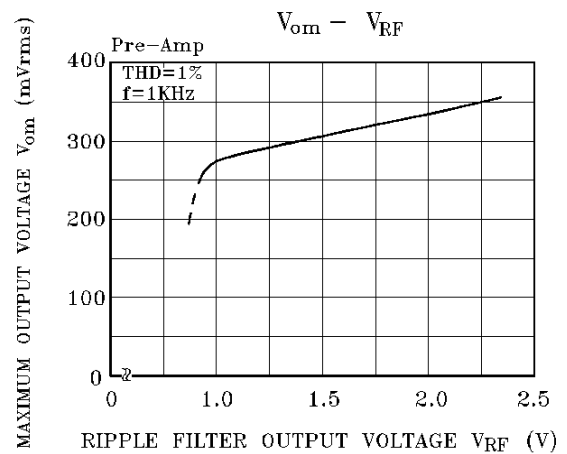
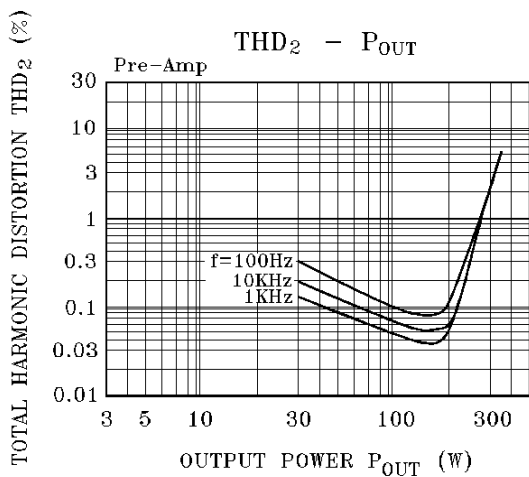
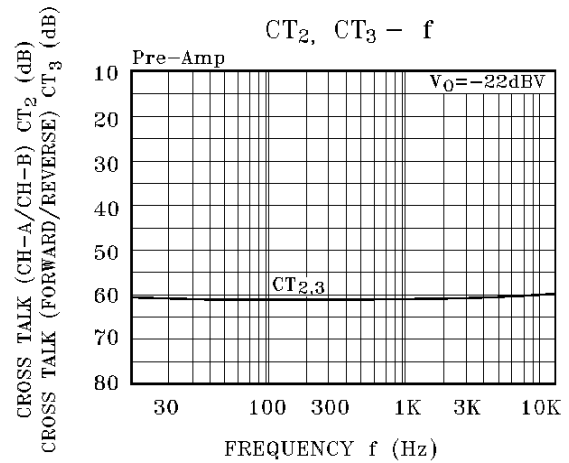
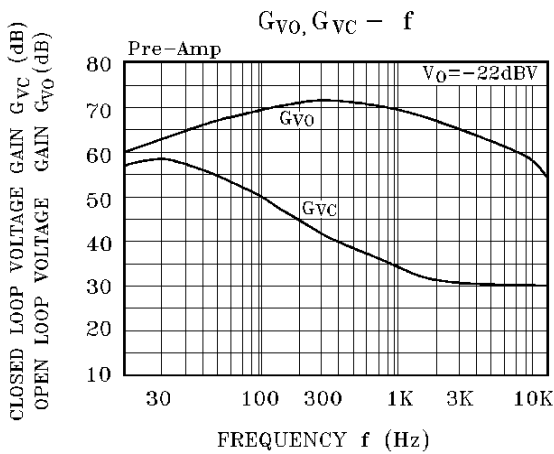
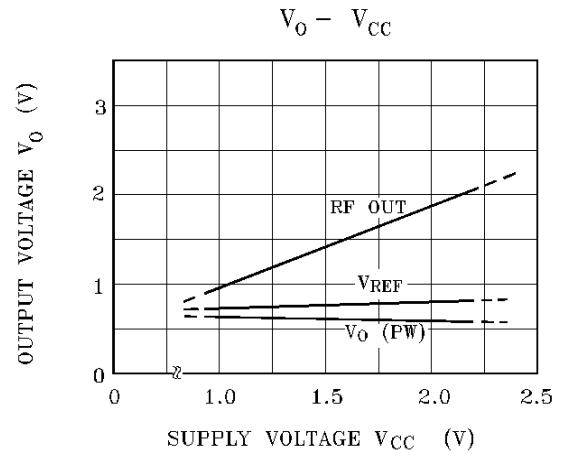
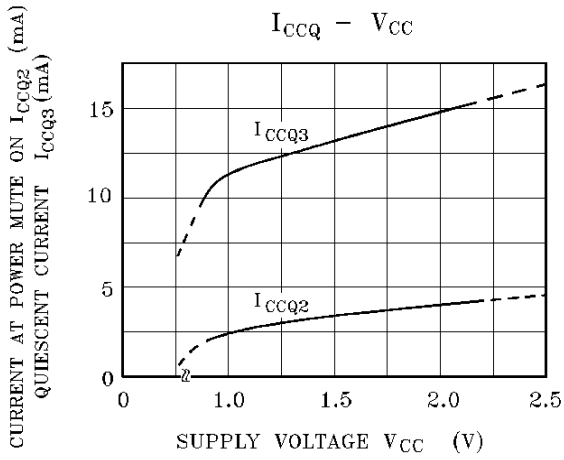
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TEST CIRCUIT 1

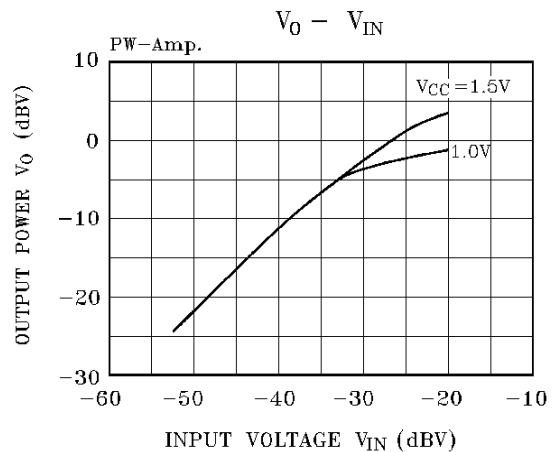
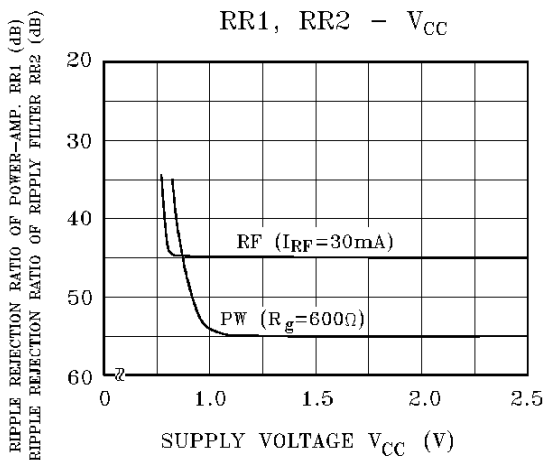
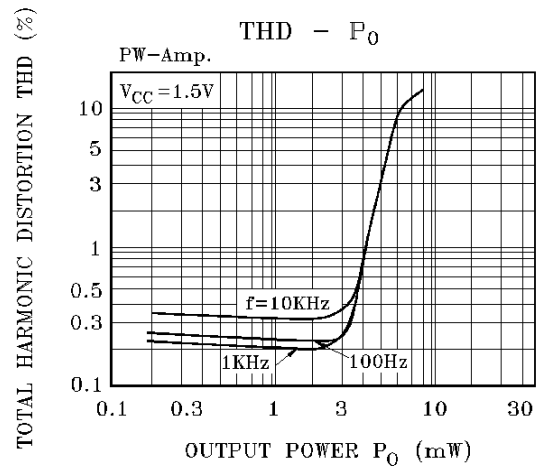
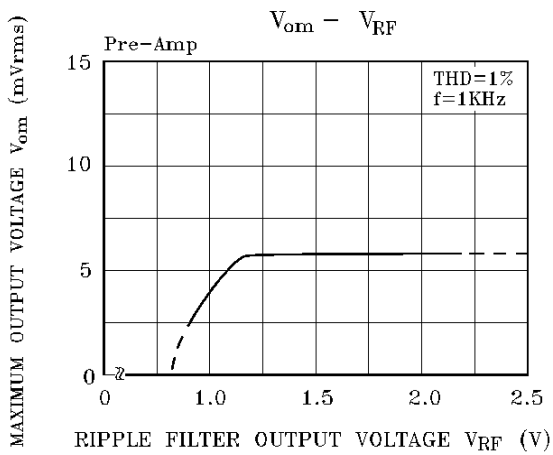
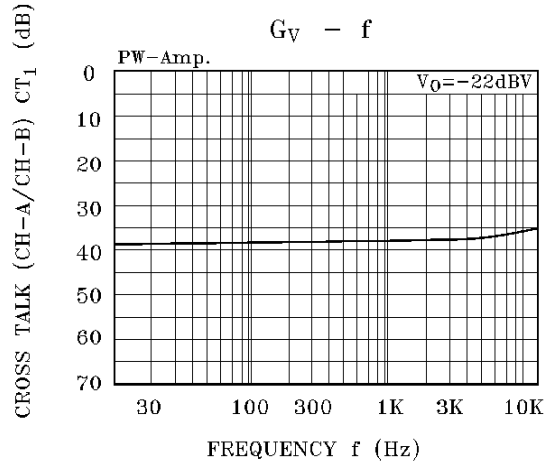
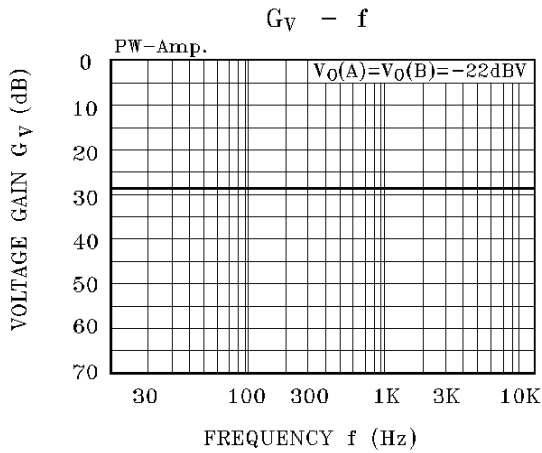


(*) Tantal Condenser

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