Ordering number : EN4218A

Thick-film Hybrid Integrated Circuit (HIC)

SANYO

No. 4218A

# STK4199MK2

## Audio Power Amplifier (THD = 0.3%) 25 W + 50 W + 25 W



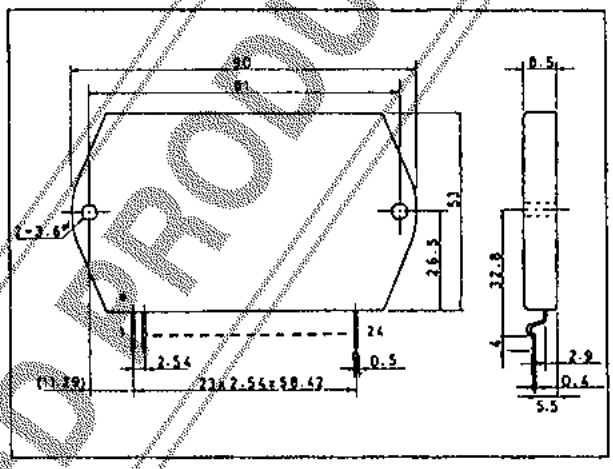
## Overview

Recent audio-visual television sets generate more impressive images by making the images higher in quality. To do this, large screens providing high-quality images are essential. Along with this, the sound must also be powerful, and full of amblence and presence. To faithfully reproduce a powerful sound field, distortion-free bass output is indispensable. Because human ears can perceive left-right directionality only for frequencies above 200 Hz, a three-dimensional (3D) system using one woofer speaker is generally employed. Also, the Dolby Surround System, used in many movie theaters, exists as a system for reproducing a spatial sound field with presence. To achieve satisfying results in audio-visual televisions, these specifications require amplifiers for a correspondingly high number of channels. To meet these needs, the STK4199MK2 is a hybrid IC that provides power amplifiers for three channels (25 W + 50 W + 25 W) in a single package.

## Package Dimensions

unit : mm

**4108**




## Applications

- 3D surround amplifier
- 3D super woofer amplifier

## Features

- Uses substrate with IMST (insulated metal substrate technology)
- The ± dual power supply provides a wide frequency band (f = 20 Hz to 50 kHz).
- Easy dolby sorround configuration
- Easy 3D amplifier configuration



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# Specifications

## Absolute Maximum Ratings at Ta = 25°C

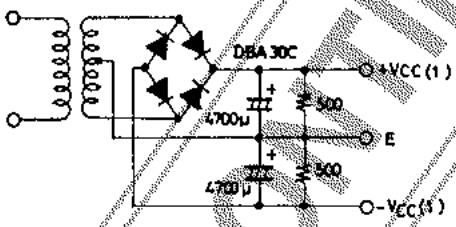
| | | | | unit |
|---|---|---|---|---|
| Maximum supply voltage | $V_{CC}$ max | L,Rch | ±39 | V |
| | | Cch | ±52.5 | V |
| Thermal resistance | θj-c | L,Rch per power transistors | 2.6 | °C/W |
| | | Cch per power transistors | 1.8 | °C/W |
| Junction temperature | Tj | | 150 | °C |
| Operating substrate temperature | Tc | | 125 | °C |
| Storage temperature | Tstg | | -30 to +125 | °C |
| Permissible load short time | $t_s$ | L,Rch $V_{CC}$=±26V, $R_L$=8Ω, f=50Hz, $P_O$=25W | 2 | sec |
| | | Cch $V_{CC}$=±35V, $R_L$=8Ω, f=50Hz, $P_O$=50W | 2 | sec |

## Operating Characteristics at Ta = 25°C, $R_L$ = 8Ω, Rg = 600Ω, VG = 40dB, $R_L$ (non-inductive)

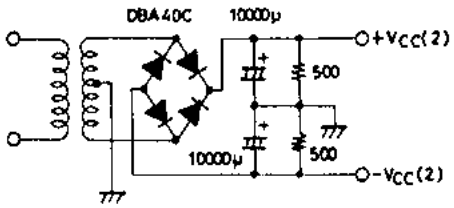
| | | | min | typ | max | unit |
|---|---|---|---|---|---|---|
| Output power | $P_O$(1) | $V_{CC}$=±26V, f=20 to 20kHz, THD=0.4%, L,Rch | 25 | | | W |
| | $P_O$(2) | $V_{CC}$=±35V, f=20 to 20 kHz, THD=0.4%, Cch | 50 | | | W |
| | $P_O$(3) | $V_{CC}$=±22V, f=1 kHz, THD=1.0%, L,Rch, $R_L$=4Ω | 25 | | | W |
| | $P_O$(4) | $V_{CC}$=±31V, f=1 kHz, THD=1.0%, Cch, $R_L$=4Ω | 55 | | | W |
| Total harmonic distortion | THD(1) | $V_{CC}$=±26V, f=1kHz, $P_O$=1.0W, L,Rch | | | 0.3 | % |
| | THD(2) | $V_{CC}$=±35V, f=1kHz, $P_O$=1.0W, Cch | | | 0.3 | % |
| Frequency response | $f_L$, $f_H$(1) | $V_{CC}$=±26V, $P_O$=1.0W, THD= $^{0}_{-3}$dB, L,Rch | 20 | | 50k | Hz |
| | $f_L$, $f_H$(2) | $V_{CC}$=±35V, $P_O$=1.0W, THD= $^{0}_{-3}$dB, Cch | 20 | | 50k | Hz |
| Input impedance | $r_i$(1) | $V_{CC}$=±26V, f=1kHz, $P_O$=1.0W, L,Rch | | 55 | | kΩ |
| | $r_i$(2) | $V_{CC}$=±35V, f=1kHz, $P_O$=1.0W, Cch | | 55 | | kΩ |
| Output noise voltage | $V_{NO}$(1) | $V_{CC}$=±31V, Rg=10kΩ, L,Rch | | | 1.2 | mVrms |
| | $V_{NO}$(2) | $V_{CC}$=±42V, Rg=10kΩ, Cch | | | 1.2 | mVrms |
| Quiescent current | $I_{CCO}$(1) | $V_{CC}$=±31V, L,Rch | 20 | 40 | 100 | mA |
| | $I_{CCO}$(2) | $V_{CC}$=±42V, Cch | 10 | 20 | 50 | mA |
| Neutral voltage | $V_N$(1) | $V_{CC}$=±31V, L,Rch | -70 | 0 | +70 | mV |
| | $V_N$(2) | $V_{CC}$=±42V, Cch | -70 | 0 | +70 | mV |

### Notes

- Use rated power supply for test unless otherwise specified.
  However, the L and R channels use ±$V_{CC}$(1) power supply, and the C channel uses ±$V_{CC}$(2) power supply.
- When measuring permissible load short time and output noise voltage use transformer power supply indicated below.
- Output noise voltage is represented by the peak value rms (VTVM) for mean reading. Use an AC stabilized power supply (50 Hz) on the primary side to eliminate the effect of AC flicker noise.

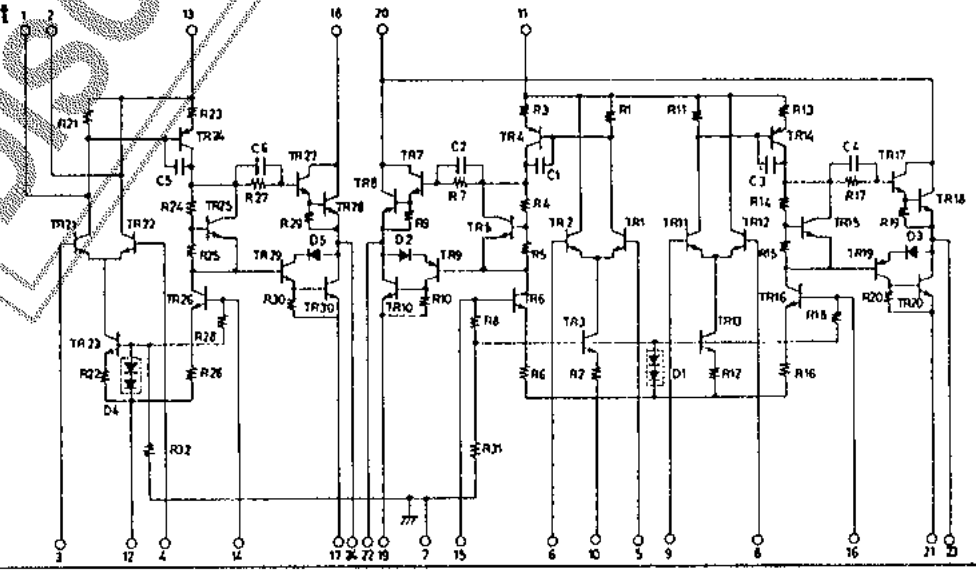



Specified Transformer Power Supply
(RP-25 Equivalent)

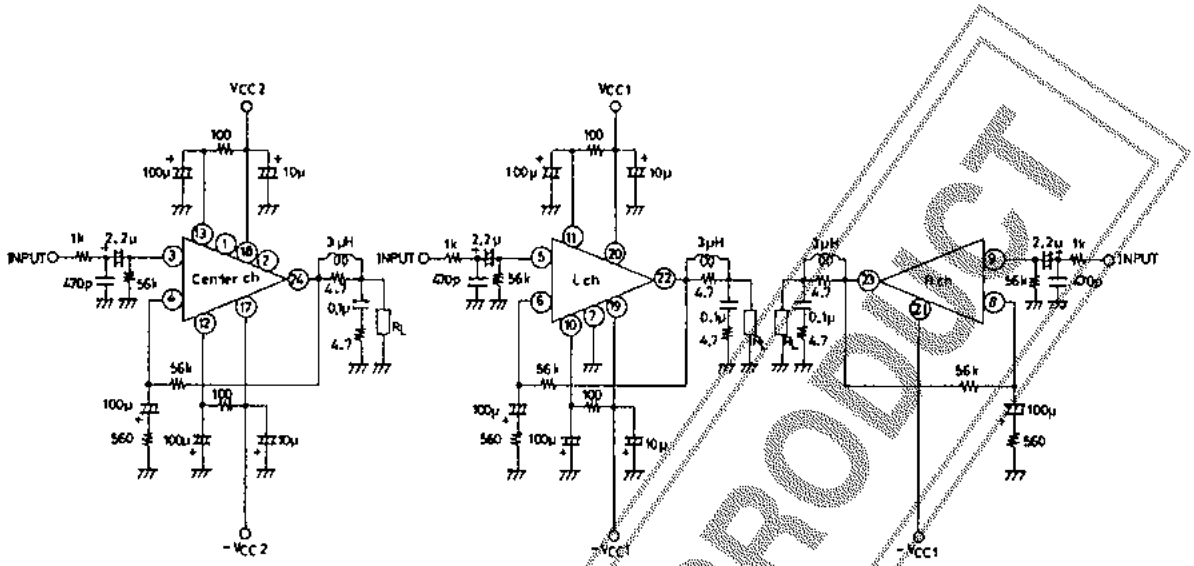



Specified Transformer Power Supply
(MG-200 Equivalent)

## Equivalent Circuit

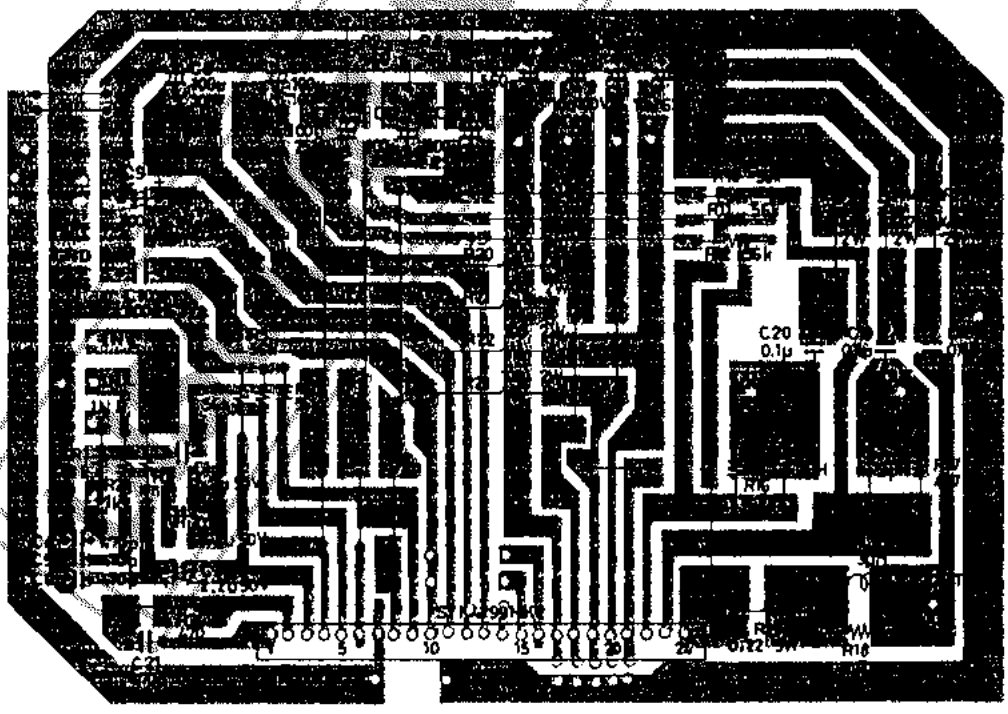


## Application Circuit

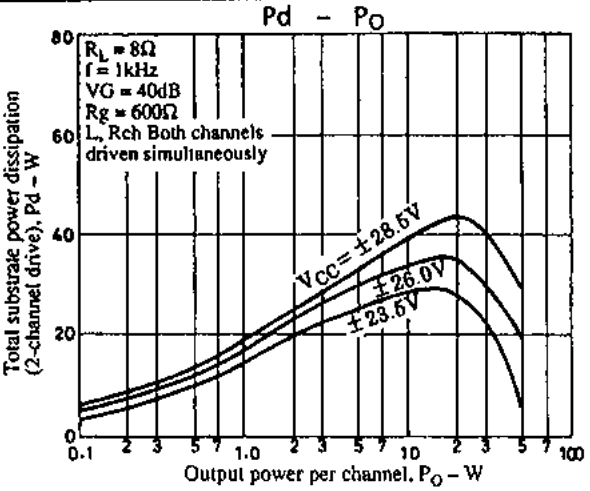





## PCB Pattern



Pd – $P_O$

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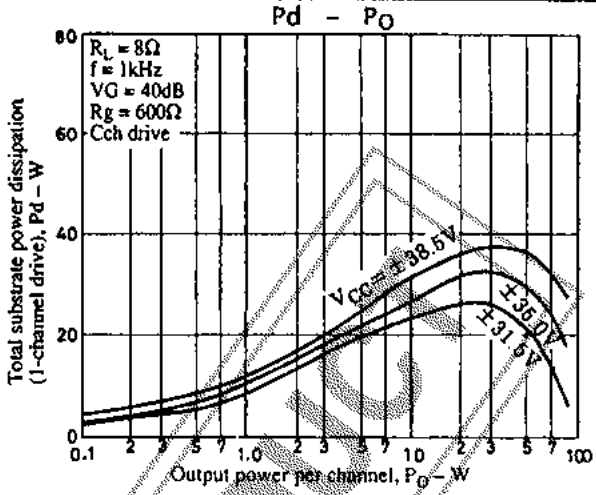
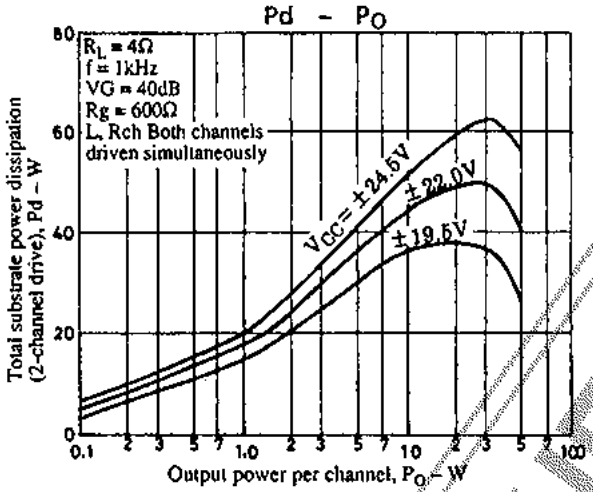
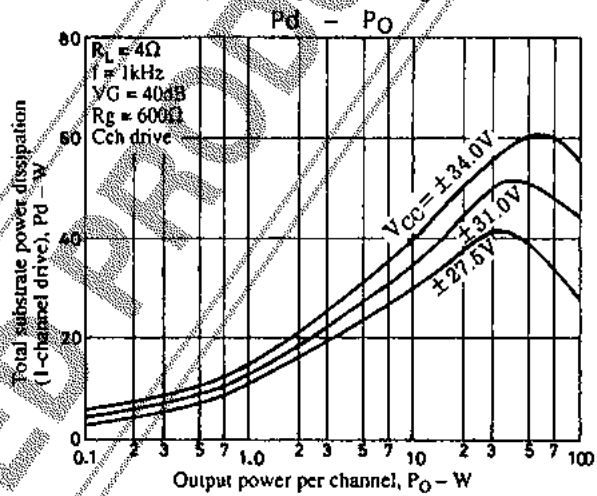


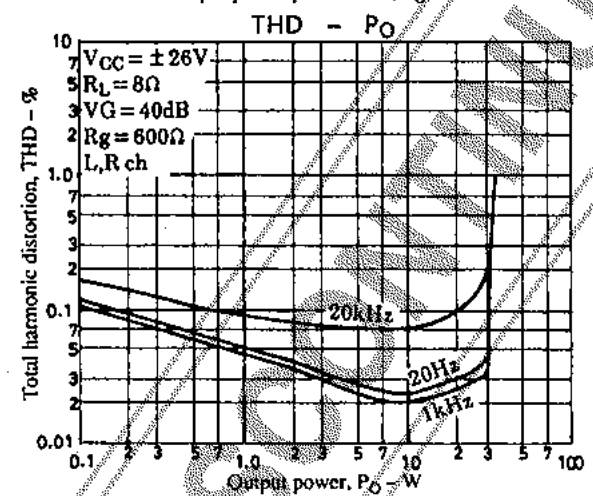

Pd – $P_O$



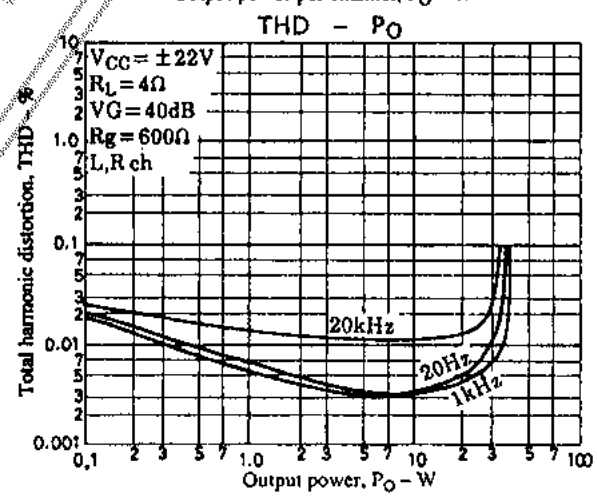

Pd – $P_O$



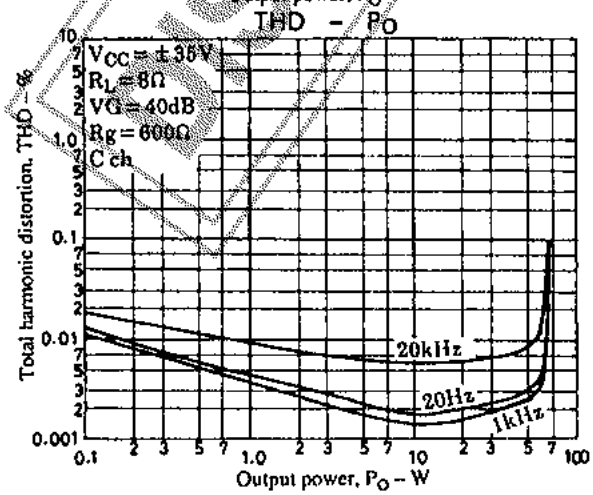

THD – $P_O$



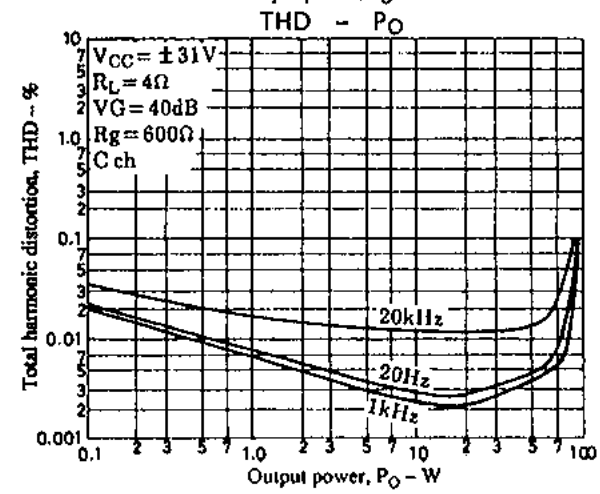

THD – $P_O$

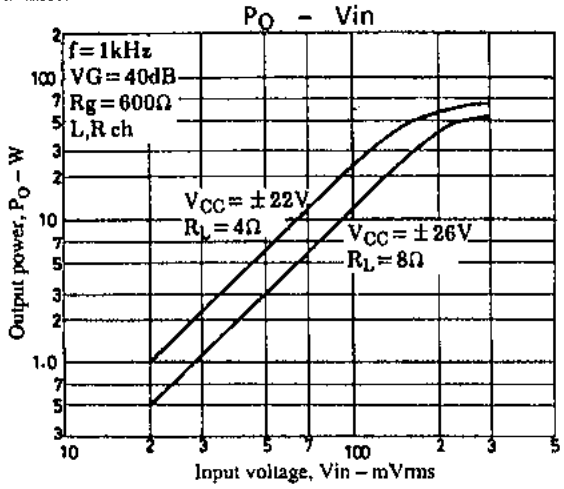


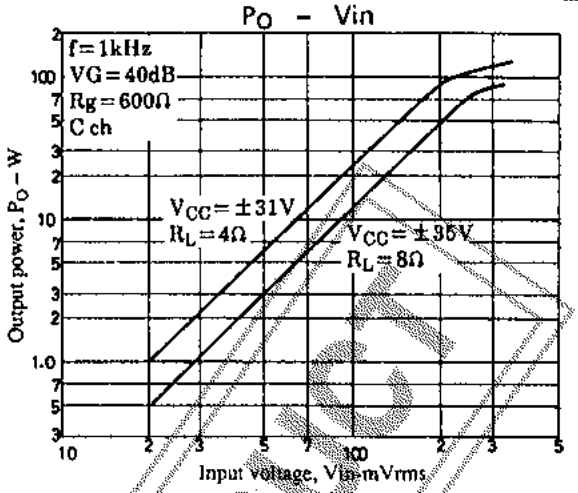

THD – $P_O$

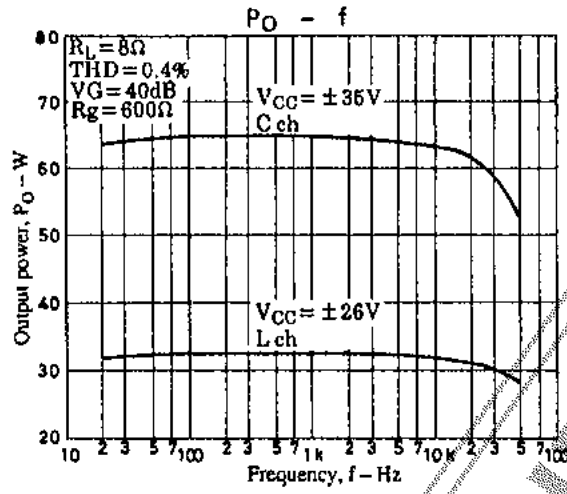


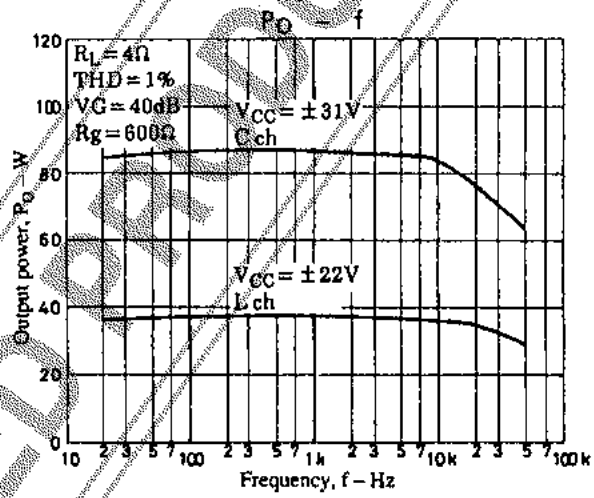

THD – $P_O$

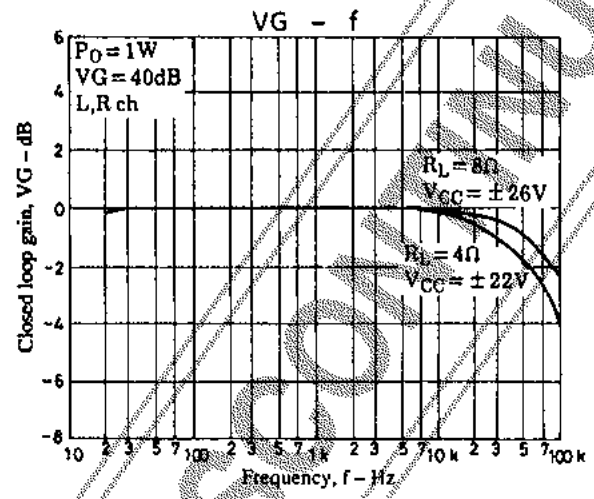


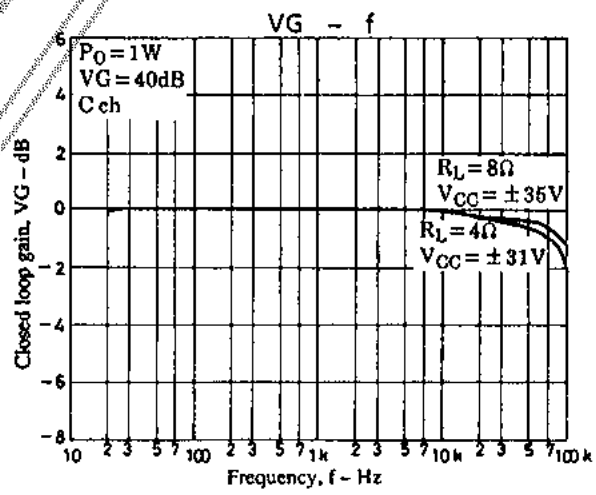


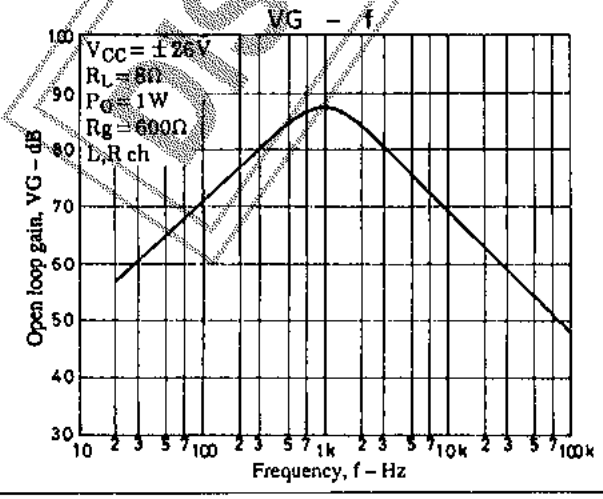



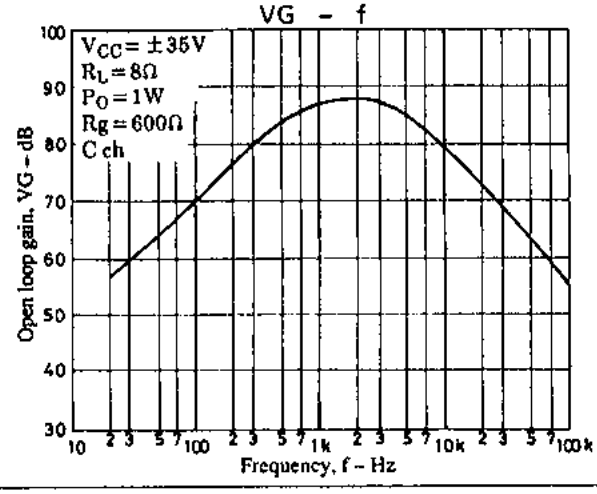



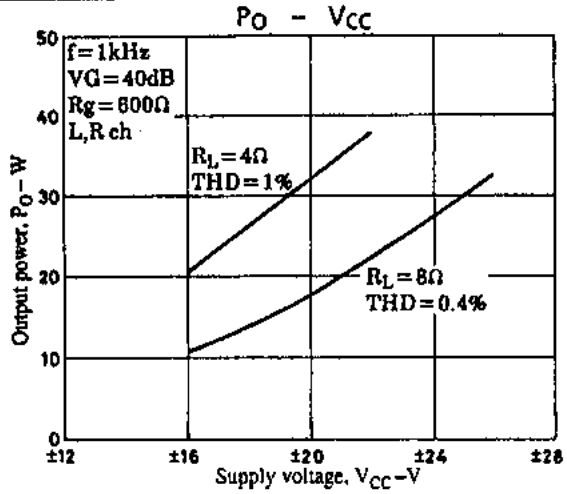



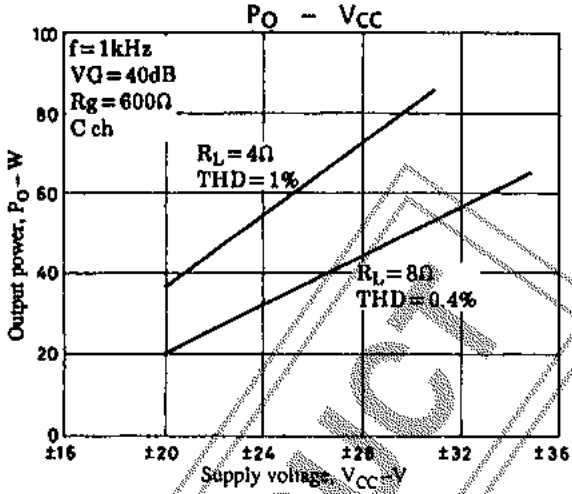



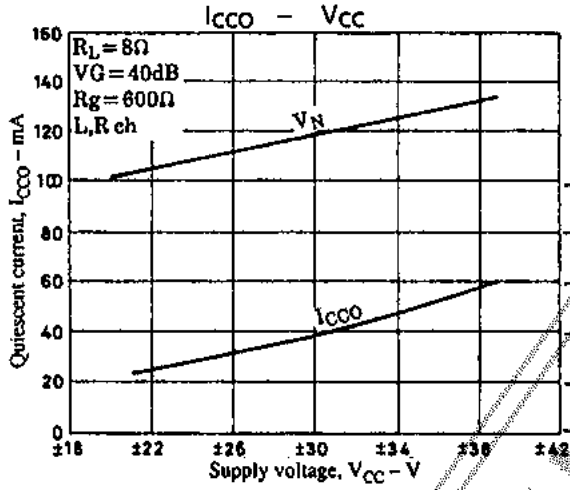
$P_O$ – $V_{CC}$



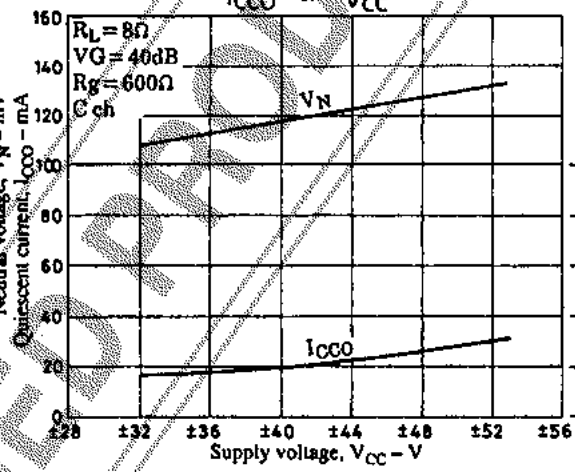

$P_O$ – $V_{CC}$



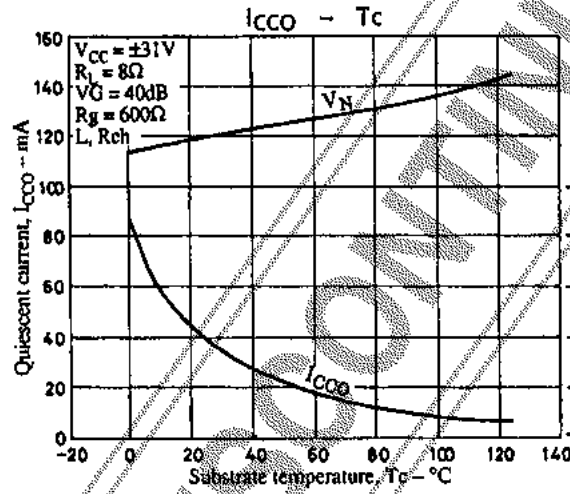

$I_{CCO}$ – $V_{CC}$



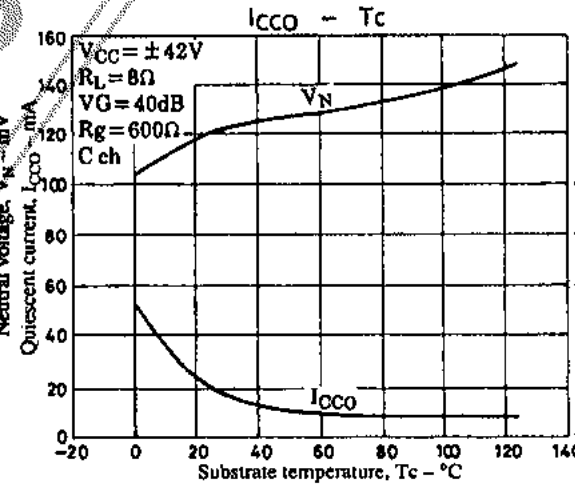

$I_{CCO}$ – $V_{CC}$



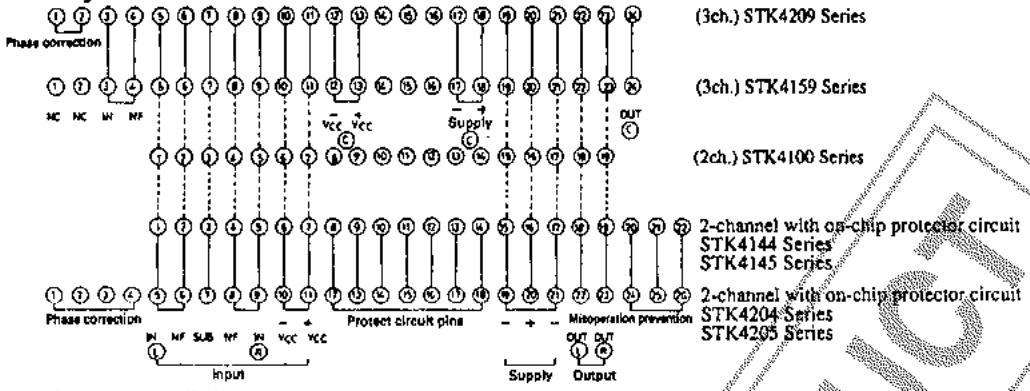

$I_{CCO}$ – Tc




$I_{CCO}$ – Tc



## Pin Compatibility with Other Series




Explanation of pin compatibility

STK4100 Series ← → STK4159 Series, STK4209 Series

STK4100 Series ← → STK4144, STK4145 Series, STK4204, STK4205 Series

Note: Protect circuits for 2- and 3-channel chips are not compatible.

## STK4199MK2 Heat Radiation Design Considerations

The radiator thermal resistance θc-a required for substrate power dissipation Pd in the STK4199MK2 is determined as:

Condition 1: IC substrate temperature Tc not to exceed 125°C.

Total Pd × θc-a+Ta <125°C ..... (1)

Ta : Set assured ambient temperature.

Total Pd : Lch Pd + Rch Pd + Cch Pd

Condition 2: Power transistor junction temperature Tj not to exceed 150°C.

Total Pd × θc-a+ (Lch Pd + Rch Pd) /N × θj-c+Ta<150°C ..... (2)

Total Pd × θc-a + Cch Pd/N' × θ'j-c + Ta < 150°C ..... (3)

N : The number of Lch, Rch power transistors

N' : The number of Cch power transistors

θj-c : The thermal resistance per Lch, Rch power transistor chip

θ'j-c : The thermal resistance per Cch power transistor chip

However, power transistor power consumption is Pd equally divided by N units.

Expressions (1), (2), and (3) can be rewritten based on θc-a to yield:

θc-a<(125–Ta)/Total Pd ..... (1)'

θc-a<(150–Ta)/Total Pd - (Lch Pd + Rch Pd) × θj-c/(Total Pd × N) ..... (2)'

θc-a<(150–Ta)/Total Pd - Cch Pd × θ'j-c/(Total Pd × N') ..... (3)'

The value that simultaneously satisfies all three expressions is the thermal resistance required of the radiator.

From expressions (1)', (2)', and (3)', the required radiator thermal resistance can be determined once the following specifications are known:

- Supply voltage $V_{CC}$
- Load resistance $R_L$
- Assured ambient temperature Ta

The total substrate power consumption when STK4199MK2 $V_{CC}$ for the L and R channels is ±26 V, $V_{CC}$ for the C channel is ±35 V, and $R_L$ is 8 Ω, for a continuous sine wave signal, is a maximum of 35.5 W for the L plus R channels and 35.5 W for the C channel (Figs. 1 and 2). In general, when this sort of continuous signal is used for estimation of power consumption, the Pd used is 1/10th of $P_O$ max (slight variation depending on safety standard).

Lch Pd + Rch Pd = 24.5W (1/10 $P_O$ max = during 2.5W)

Cch Pd = 22W (1/10 Pd max = during 5.0W)

Total Pd = Lch Pd + Rch Pd +Cch Pd = 46.5W

The STK4199MK2 has four power transistors for the L and R channels (N) and two for the C channel (N'), so the thermal resistance per L and R channel transistor (θj-c) is 2.6°C / W and 1.8°C / W per C channel transistor (θ'j-c).

With an assured ambient temperature Ta of 50°C, the required radiator thermal resistance θc-a would be:

From expression (1)' θc-a <(125–50)/46.5 <1.612

From expression (2)' θc-a <(150–50)/46.5 - 24.5 × 2.6/(46.5 × 4) <1.808

From expression (3)' θc-a <(150–50)/46.5 - 22 × 1.8/(46.5 × 2) <1.724

To satisfy both, 1.339°C / W is the required radiator thermal resistance. This design example is based on a fixed voltage supply, and will require verification within your specific set environment.