



# STK4132 II

## 2ch AF Power Amplifier (Split Power Supply) (20W + 20W min, THD = 1%)

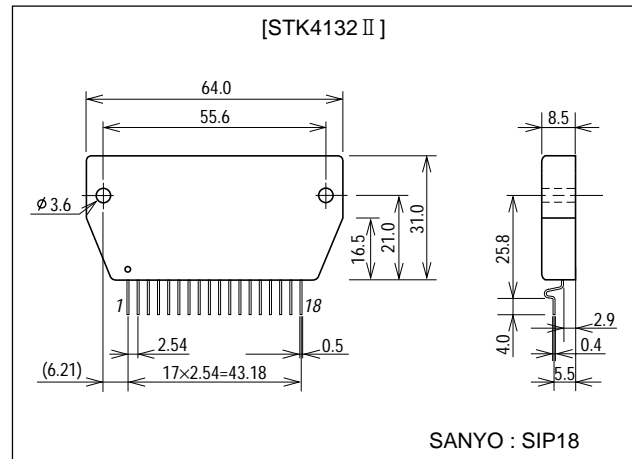
### Features

- Pin compatible with the STK4102 II and STK4101V series (high-grade type) over the output range 6 to 50W for easy interchangeability
- Small-sized package with the same pin assignment as the STK4101 II series
- Built-in muting circuit to cut off spurious shock noise
- 125°C guaranteed high temperature operation allows greatly reduced heat sink size
- Excellent low-cost performance

### Package Dimensions

unit:mm

4083



### Specifications

Maximum Ratings at  $T_a = 25^\circ\text{C}$

| Parameter                             | Symbol               | Conditions   | Ratings     | Unit                      |
|---------------------------------------|----------------------|--|-------------|---------------------------|
| Maximum supply voltage                | $V_{CC \text{ max}}$ |  | $\pm 34.5$  | V                         |
| Thermal resistance                    | $\theta_{j-c}$       |  | 3.0         | $^\circ\text{C}/\text{W}$ |
| Junction temperature                  | $T_j$                |  | 150         | $^\circ\text{C}$          |
| Operating substrate temperature       | $T_c$                |  | 125         | $^\circ\text{C}$          |
| Storage temperature                   | $T_{stg}$            |  | -30 to +125 | $^\circ\text{C}$          |
| Available time for load short-circuit | $t_s$                | $V_{CC} = \pm 23\text{V}$ , $R_L = 8\Omega$ , $f = 50\text{Hz}$ , $P_O = 20\text{W}$ | 2           | s                         |

Recommended Operating Conditions at  $T_a = 25^\circ\text{C}$

| Parameter       | Symbol   | Conditions | Ratings  | Unit     |
|-----------------|----------|------------|----------|----------|
| Supply voltage  | $V_{CC}$ |            | $\pm 23$ | V        |
| Load resistance | $R_L$    |            | 8        | $\Omega$ |

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**Operating Characteristics** at  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = \pm 23\text{V}$ ,  $R_L = 8\Omega$  (non-inductive load),  $R_g = 600\Omega$ ,  $V_G = 40\text{dB}$

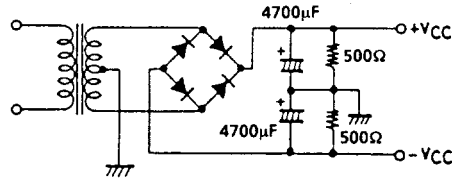
| Parameter                 | Symbol     | Conditions  | Ratings |           |     | Unit       |
|---------------------------|------------|---|---------|-----------|-----|------------|
|                           |            |   | min     | typ       | max |            |
| Quiescent current         | $I_{CCO}$  | $V_{CC} = \pm 28\text{V}$   | 20      | 40        | 100 | mA         |
| Output power              | $P_{O1}$   | THD=0.4%, $f = 20\text{Hz}$ to $20\text{kHz}$                             | 20      |           |     | W          |
|                           | $P_{O2}$   | $V_{CC} = \pm 20\text{V}$ , THD=1.0%, $R_L = 4\Omega$ , $f = 1\text{kHz}$ | 20      |           |     | W          |
| Total harmonic distortion | THD        | $P_O = 1.0\text{W}$ , $f = 1\text{kHz}$                                   |         |           | 0.3 | %          |
| Frequency response        | $f_L, f_H$ | $P_O = 1.0\text{W}$ , $+0, -3$ dB   |         | 20 to 50k |     | Hz         |
| Input resistance          | $r_i$      | $P_O = 1.0\text{W}$ , $f = 1\text{kHz}$                                   |         | 55        |     | k $\Omega$ |
| Neutral voltage           | $V_N$      | $V_{CC} = \pm 50.5\text{V}$   | -70     | 0         | +70 | mV         |
| Output noise voltage      | $V_{NO}$   | $V_{CC} = \pm 28\text{V}$ , $R_g = 10\text{k}\Omega$                      |         |           | 1.2 | mVrms      |
| Muting voltage            | $V_M$      |   | -2      | -5        | -10 | V          |

Note.

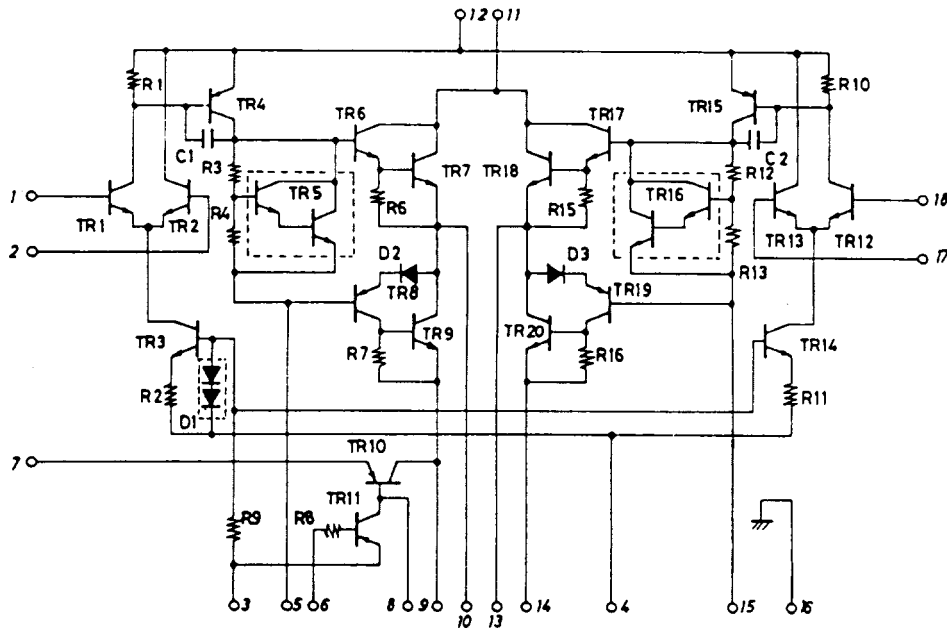
All tests are made using a constant-voltage supply unless otherwise specified.

Available time for load short-circuit and output noise voltage are measured using the transformer supply specified below. The output noise voltage is the peak value of an average-reading meter with an rms value scale (VTVM). A regulated AC supply (50Hz) should be used to eliminate the effects of AC primary line flicker noise.

## Specified Transformer Supply (RP-25 or Equivalent)

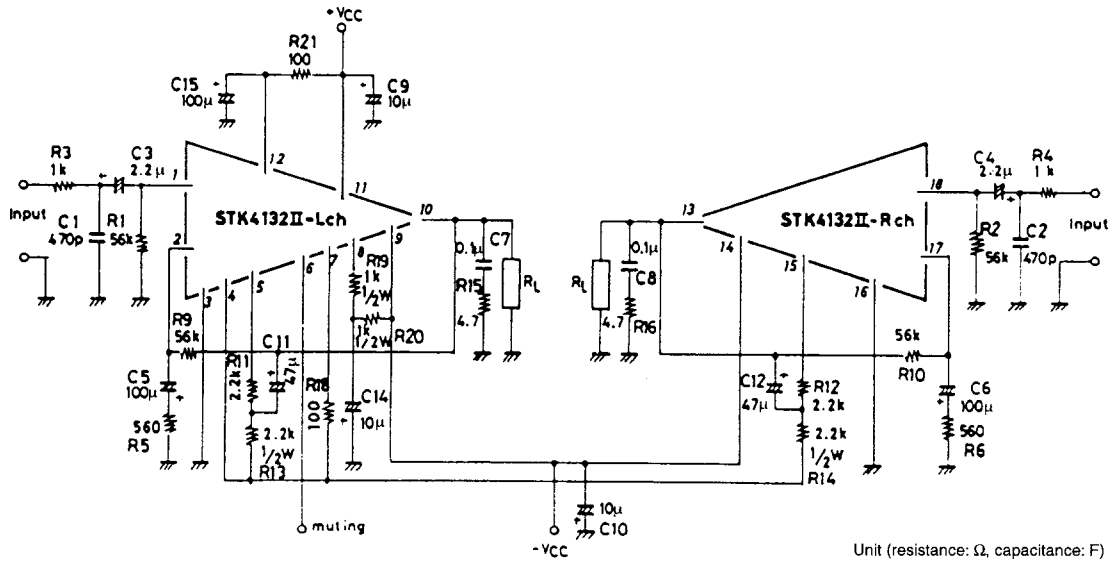


## Equivalent Circuit

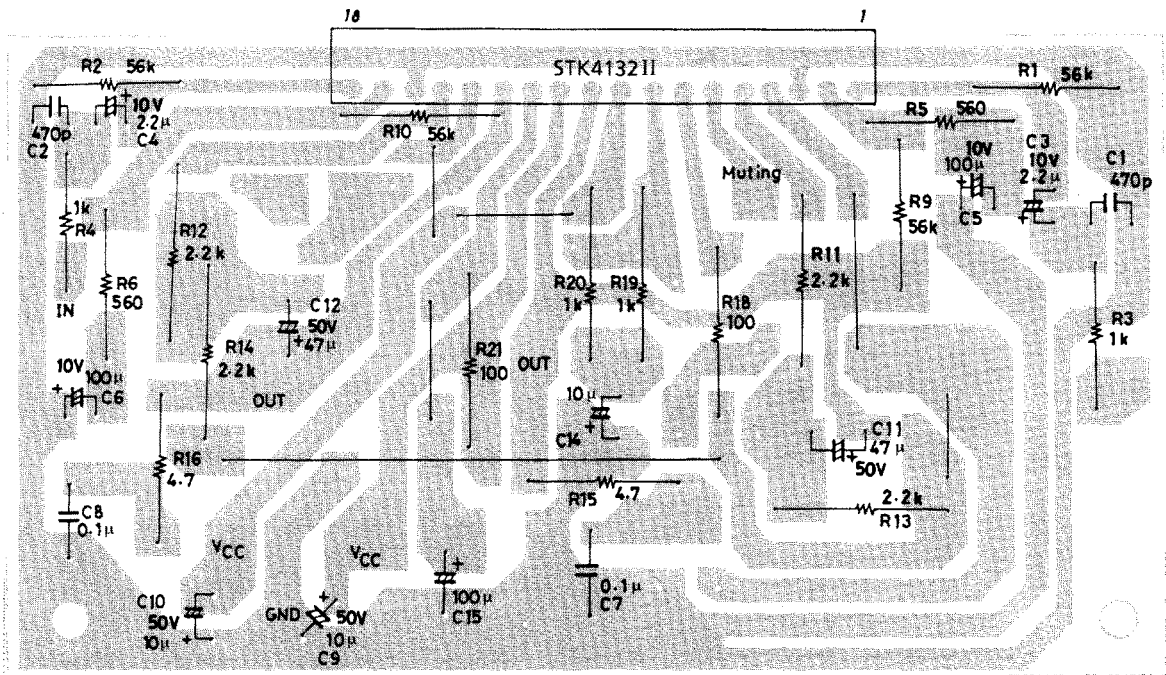


# STK4132 II

## Sample Application Circuit (20W min, 2-Channel, AF Power Amplifier)

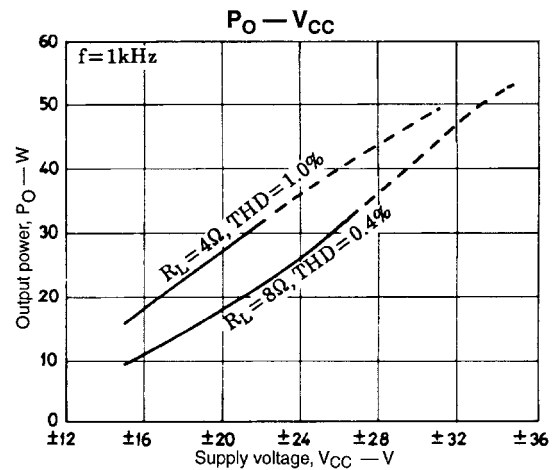
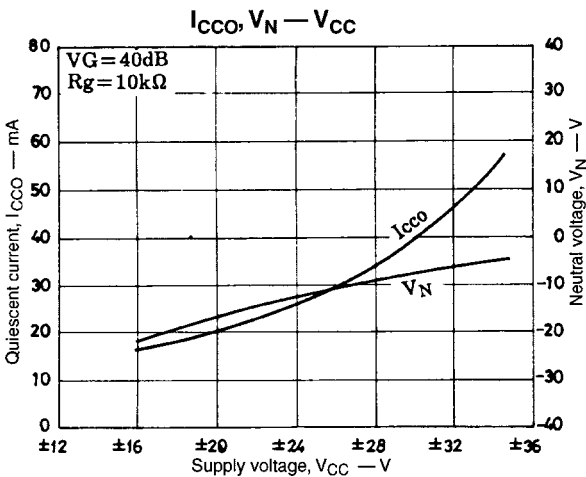
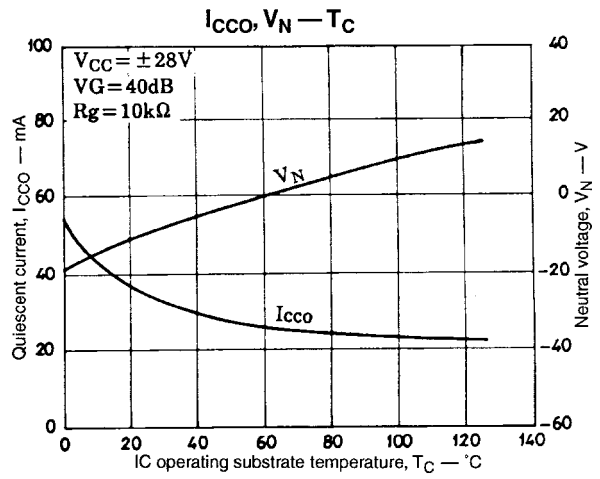
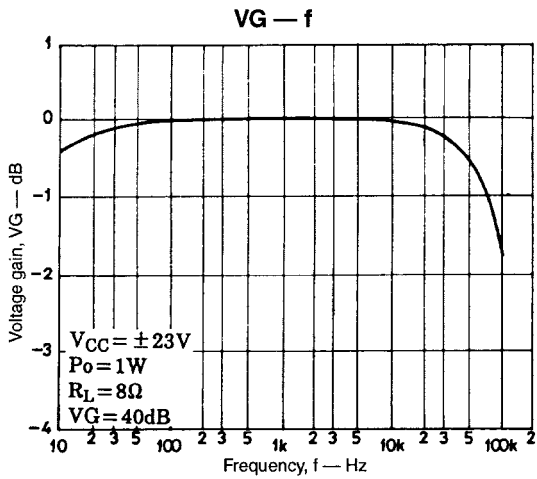
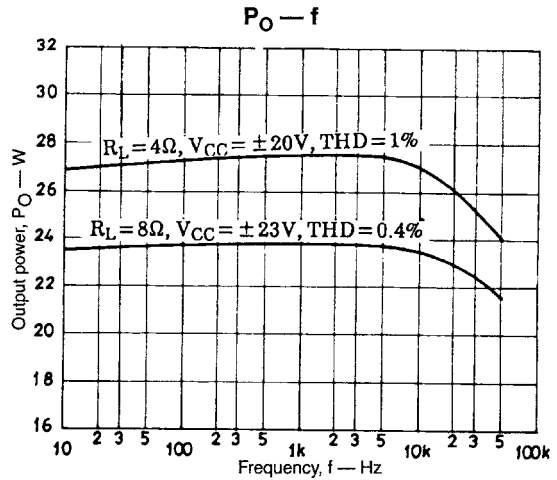
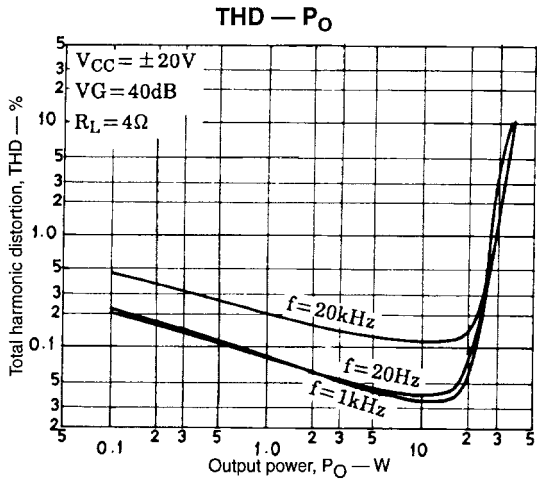
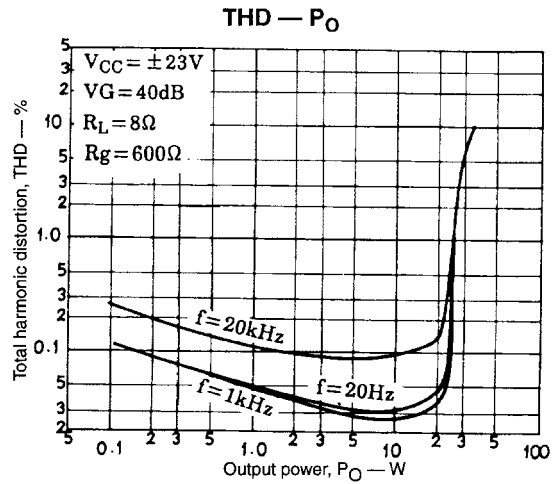
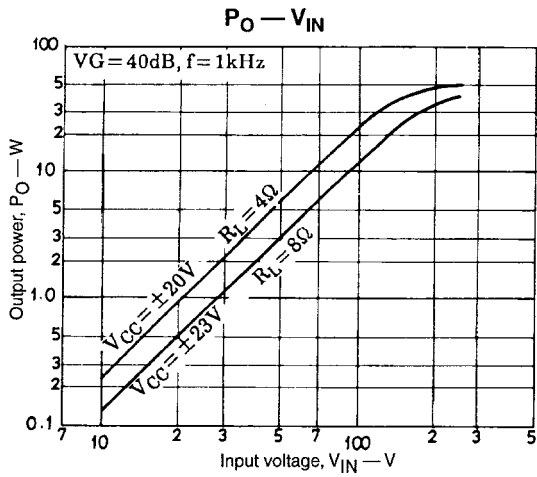


## Sample Application Circuit PCB Layout (Copper Foil Surface)

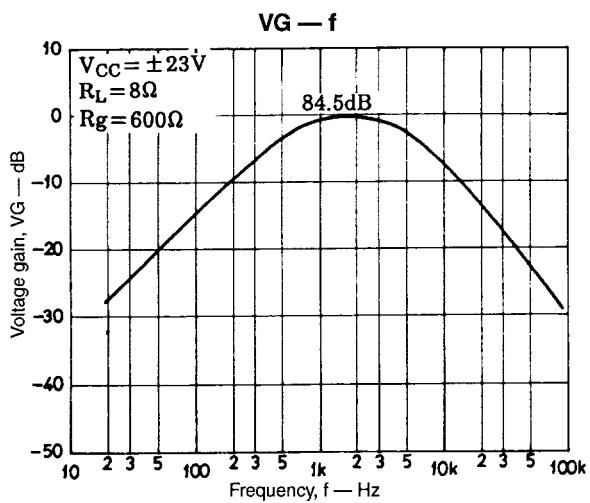
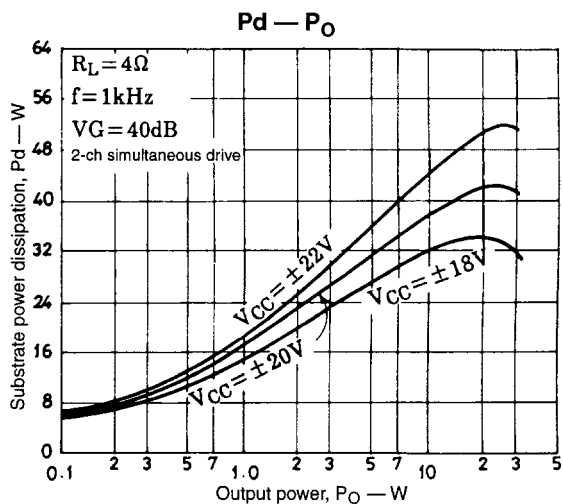
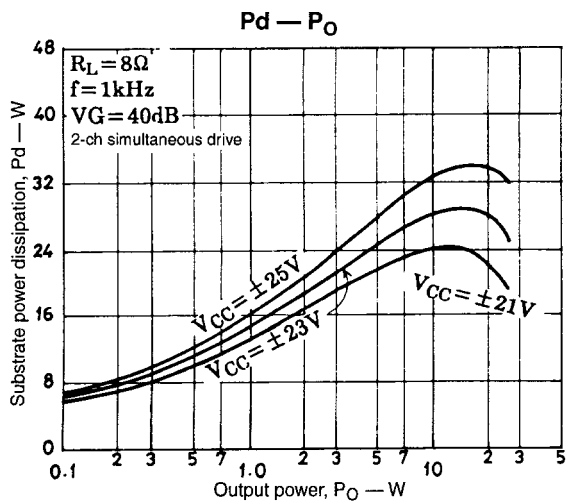


50 x 100mm<sup>2</sup>

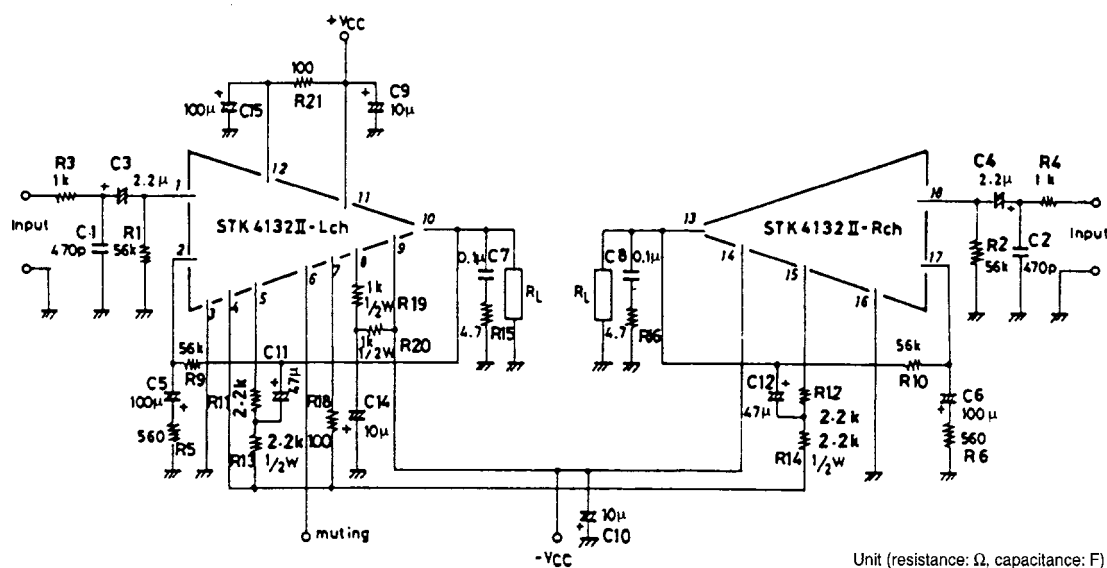
Unit (resistance: Ω, capacitance: F)



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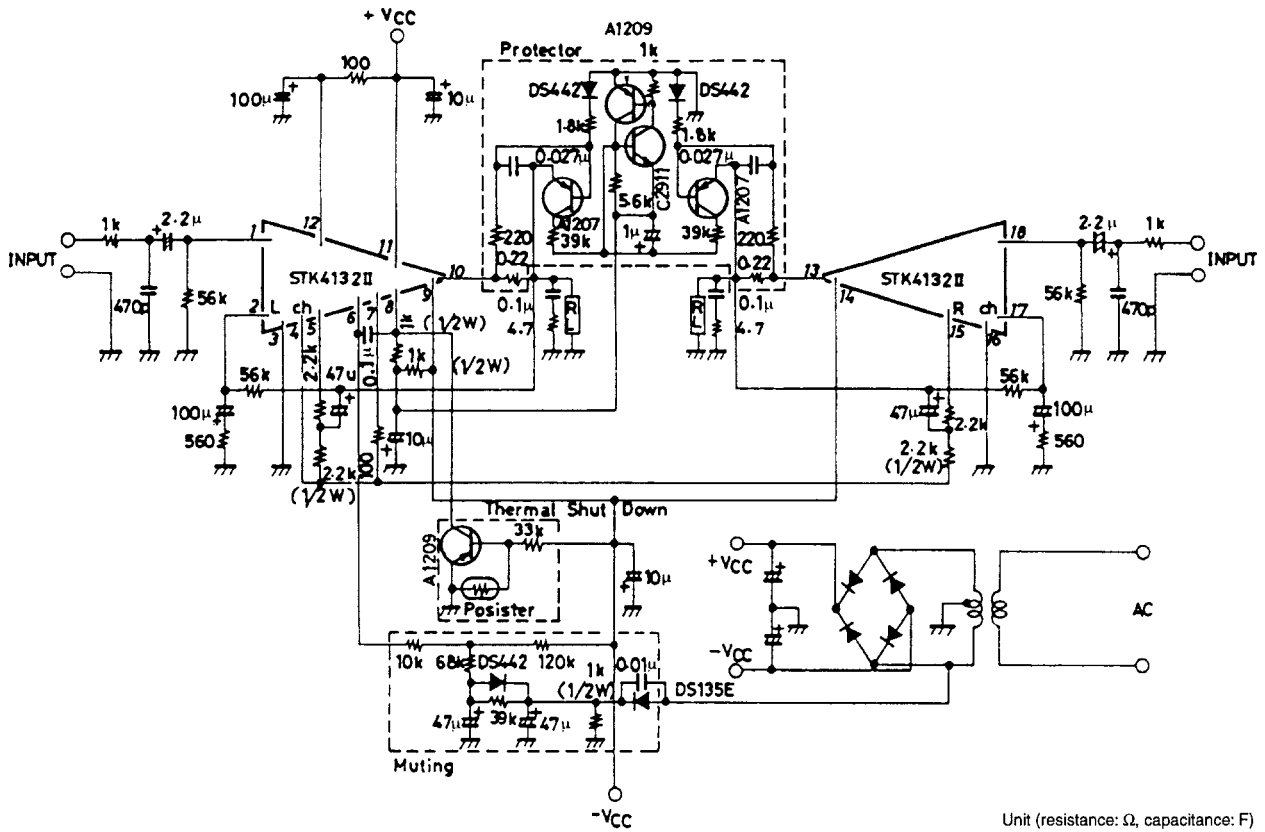


External Component Description



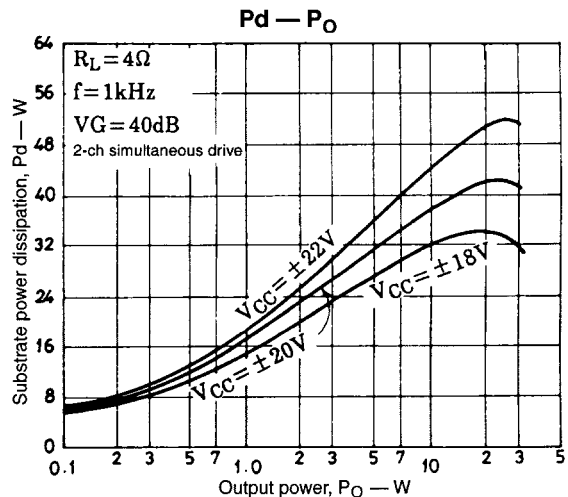
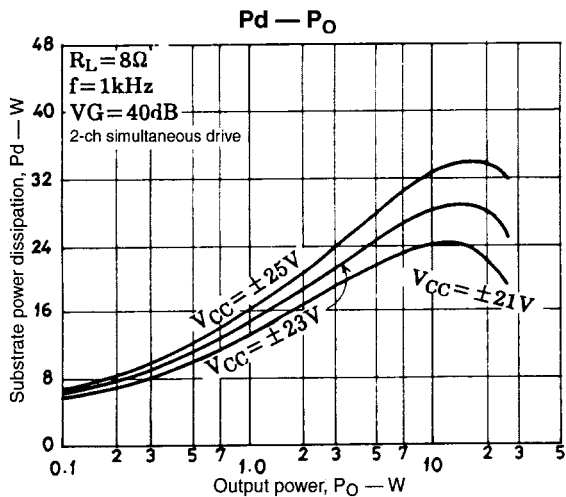
|                        |   |
|------------------------|---|
| C1, C2                 | Input filter capacitors.<br>These, together with R3 and R4, form filters to reduce high-band noise.   |
| C3, C4                 | Input coupling capacitors.<br>For DC blocking. Since capacitor reactance becomes larger at lower frequencies, the output noise can be adversely affected by signal source resistance-dependent 1/f noise. In this case, a lower reactance value should be chosen. In order to remove pop noise at power-on, larger values of capacitance should be chosen for C3 and C4, which determine the input time constant, and smaller values for C5 and C6 in the NF circuit. |
| C5, C6                 | NF capacitors.<br>These determine the low-side cutoff frequency.<br>$f_L = \frac{1}{2\pi \times C5 \times R5} \text{ [Hz]}$<br>A large values should be chosen for C5 to maintain voltage gain at low frequencies. However, because this would tend to increase the shock noise at power-on, a values larger than absolutely necessary should be avoided.   |
| C15                    | Decoupling capacitors.<br>This removes shock noise and ripple voltage from the supply.  |
| C11, C12               | Bootstrap capacitors.<br>If these capacitors are made small, then the total harmonic distortion at low frequencies increases significantly.   |
| C9, C10                | Oscillation prevention capacitors.<br>These should be inserted as close as possible to the IC supply pins to reduce supply impedance and hence provide stable IC operation. Electrolytic capacitors are recommended.  |
| C14                    | Ripple filter capacitor.<br>This forms a ripple filter in combinatin with internal transistor TR10.   |
| C7                     | Oscillation prevention capacitors.<br>Mylar capacitors are recommended for their excellent thermal and frequency characteristics.   |
| R3, R4                 | Input filter resistors.   |
| R1, R2                 | Input bias resistors.<br>These are used to bias the input pins at aro potential. The input impedance is largely determined by this resistance.  |
| R5, R9<br>(R6, R10)    | Voltage-gain VG setting resistors.<br>VG=40dB is recommended using R5, R6=560Ω, and R9, R10=56kΩ. Gain adjustments are best made using R5 and R6. If gain adjustments are made using R5 and R6, then set R1, R2=R9, R10 to maintain V <sub>N</sub> balance stability.   |
| R11, R13<br>(R12, R14) | Bootstrap resistors.<br>These resistors determine the quiescent current. Values of 2.2kΩ and 2.2kΩ are recommended.   |
| R21                    | Ripple filter testistor.<br>This resistor performs as predriver transistor limiting resistor during load short circuits.  |
| R18                    | Clipping plus/minus balance resistor.   |
| R19, R20               | Ripple filter resistors.<br>When muting transistor TR11 is on, current flows from ground through TR11 to -V <sub>CC</sub> . Values of 1kΩ (0.5W) and 1kΩ (0.5W) are recommended.  |
| R15, R16               | Oscillation prevention resistors.   |

Sample Application Circuit (Protection and Muting Circuit)



Heatsink Design

The total STK4132 II device power dissipation for a continuous sine wave signal is shown in figures 1 and 2. The maximum dissipation is 29.2W for  $R_L=8\Omega$ , and 42.8W for  $R_L=4\Omega$  (2-channel simultaneous drive).



When estimating the power dissipation for an actual audio signal input, the rule of thumb is to select Pd corresponding to  $(1/10) \times P_O \text{ max}$  (within safe limits) for a continuous sine wave input. For example,

$$Pd=18.6W \text{ for } 8\Omega, \text{ and } Pd=23W \text{ for } 4\Omega$$

The heatsink thermal resistance,  $\theta_{j-a}$ , required to dissipate the STK41322 device total power dissipation, Pd, is determined as follows :

Condition 1: IC substrate temperature not to exceed 125°C  
 $T_C = Pd \times \theta_{c-a} + T_a < 125^\circ C \dots\dots\dots (1)$

where Ta is the guaranteed maximum ambient temperature.

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

$$T_j = Pd \times \theta_{c-a} + Pd/4 \times \theta_{j-c} + T_a < 150^\circ C \dots\dots\dots (2)$$

The STK4132 II has 4 power transistors (2 per channel), and the thermal resistance per transistor,  $\theta_{j-c}$ , is 3.0°C/W. Therefore, equation 2 becomes :

$$Pd \times (\theta_{c-a} + 3.0/4) + T_a < 150^\circ C \dots\dots\dots (3)$$

The required heatsink must have a thermal resistance that satisfies both expressions 1 and 3. Figure 3 shows the ambient temperature parameter against Pd and  $\theta_{j-a}$  calculated from equations 1 and 3.

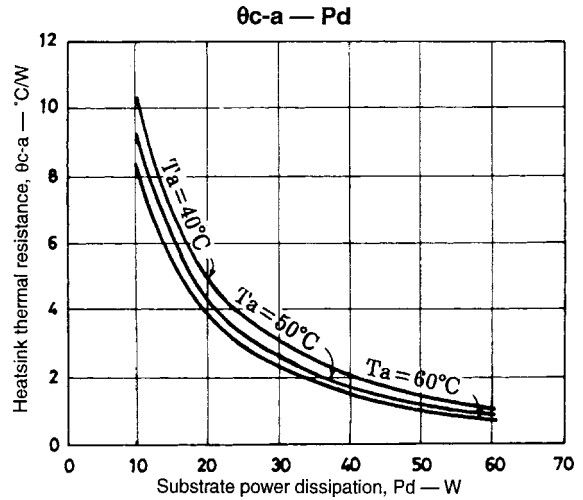


Figure 3.  $\theta_{c-a} - Pd$

For example, a stereo amplifier with ambient temperature of  $T_a=50^\circ C$  needs a heatsink with thermal resistance given by the following :

For  $V_{CC}=\pm 23V, R_L=8\Omega :$

$1/10 P_O \text{ max}$  corresponds  $Pd1=18.6W$

From figure 3, the STK4132 II thermal resistance is  $\theta_{c-a1}=4.01^\circ C/W$

From equation 3, this results in a junction temperature  $T_j=139.1^\circ C$

For  $V_{CC}=\pm 20V, R_L=4\Omega :$

$1/10 P_O \text{ max}$  corresponds  $Pd2=23W$

From figure 3, the STK4132 II thermal resistance is  $\theta_{c-a2}=3.26^\circ C/W$

From equation 3, this results in a junction temperature  $T_j=142.3^\circ C$

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