Ordering number: EN 4595A

Thick Film Hybrid IC

# STK401-110

## AF Power Amplifier (Split Power Supply) (70W+70W min, THD = 0.4%)

### Overview

The STK401-110 is a thick-film audio power amplifier IC belonging to a series in which all devices are pin compatible. This allows a single PCB design to be used to construct amplifiers of various output capacity simply by changing hybrid ICs. Also, this series is part of a new, larger series that comprises mutually similar devices with the same pin compatibility. This makes possible the development of a 2-channel amplifier from a 3-channel amplifier using the same PCB. In addition, this new series features 6/3Ω drive in order to support the low impedance of modern speakers.

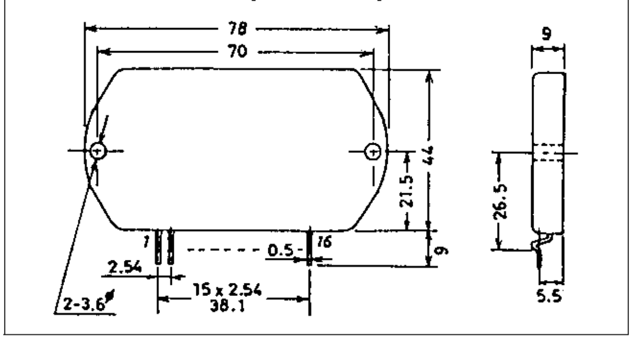
### Features

- Pin compatible
  STK400-000 series (3-channel/single package)
  ↓
  STK401-000 series (2-channel/single package)
- Output load impedance $R_L$ = 6/3Ω supported
- New pin configuration
  Pin configuration has been grouped into individual blocks of inputs, outputs and supply lines, minimizing the adverse effects of pattern layout on operating characteristics.
- Few external components
  In comparison with existing series, external bootstrap resistors and capacitors can be eliminated.

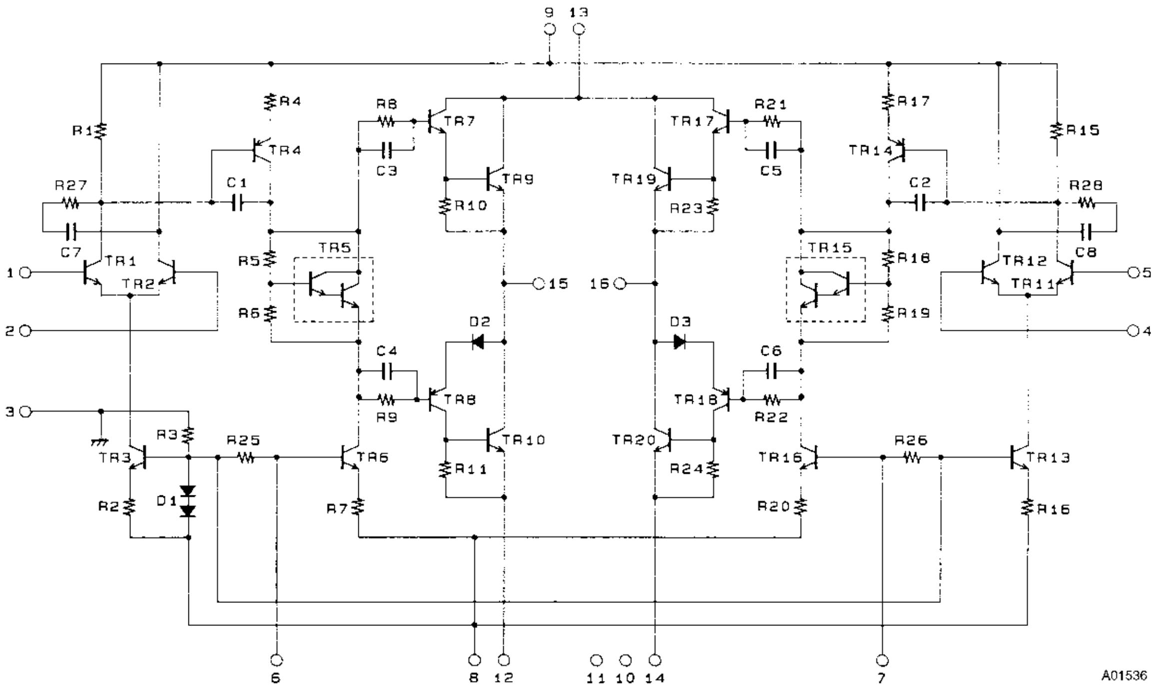
### Package Dimensions

unit: mm

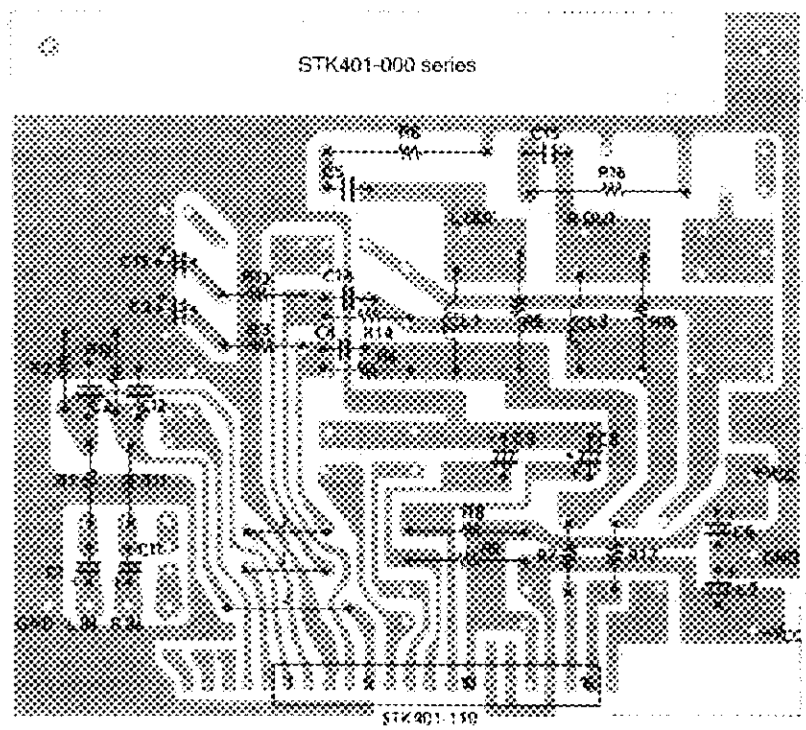
**4029**



## Equivalent Circuit

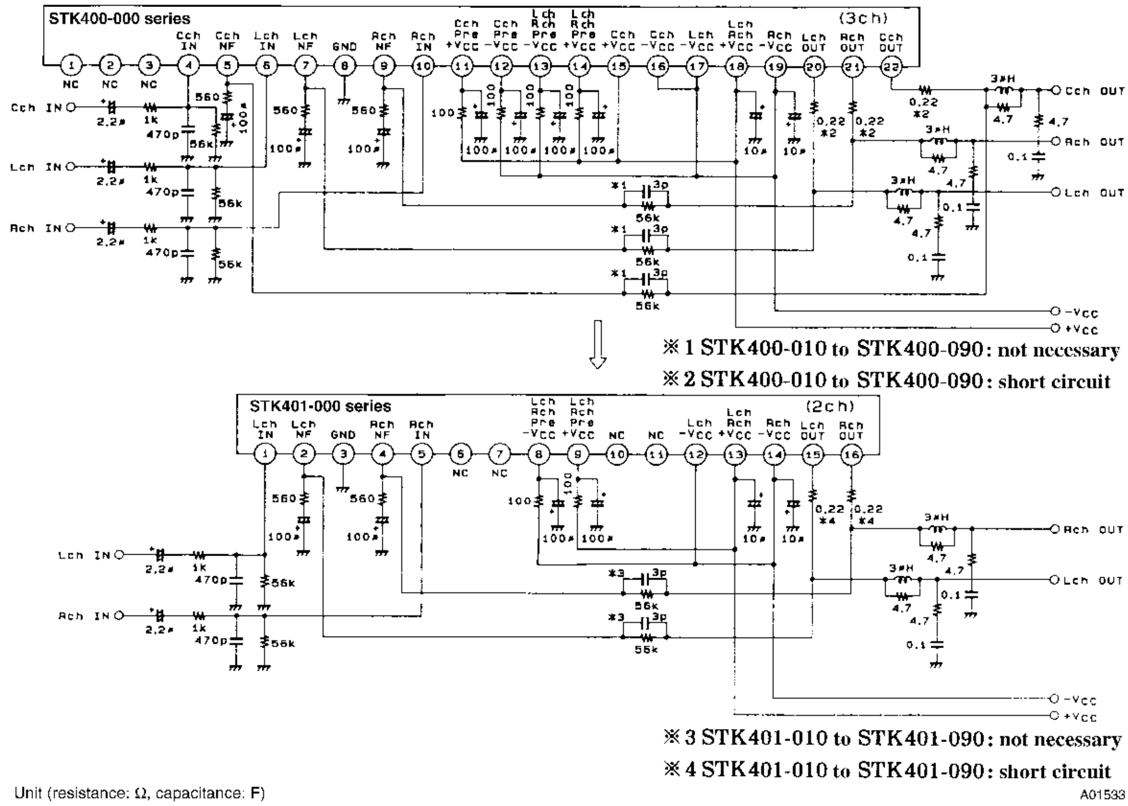



## Sample PCB Layout for 2-Channel or 3-Channel Amplifiers




Copper (Cu) foil surface
Pin 6 of STK400-000 series devices corresponds to pin 1 of STK401-000 series devices.

## External Circuit Diagram




## Heatsink Design Considerations

The heatsink thermal resistance, θc-a, required to dissipate the STK401-110 device total power dissipation, Pd, is determined as follows:

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

Pd × θc-a + Ta < 125°C ........................................ (1)

where Ta is the guaranteed maximum ambient temperature.

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

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

where N is the number of power transistors and θj-c is the power transistor thermal resistance per transistor. Note that the power dissipated per transistor is the total, Pd, divided evenly among the N power transistors.

Expressions (1) and (2) can be rewritten making θc-a the subject.

θc-a < (125 – Ta)/Pd ............................................. (1)′

θc-a < (150 – Ta)/Pd – θj-c/N .............................. (2)′

The heatsink required must have a thermal resistance that simultaneously satisfies both expressions.

The heatsink thermal resistance can be determined from (1)′ and (2)′ once the following parameters have been defined.

- Supply voltage
- Load resistance
- Guaranteed maximum ambient temperature

The total device power dissipation when STK401-110 $V_{CC}$ = ±38V and $R_L$ = 6Ω, for a continuous sine wave signal, is a maximum of 98.5W, as shown in Figure 1.

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

Pd = 61.2W (for 1/10 $P_O$ max = 7W)

The STK401-110 has 4 power transistors, and the thermal resistance per transistor, θj-c, is 1.4°C/W. If the guaranteed maximum ambient temperature, Ta, is 50°C, then the required heatsink thermal resistance, θc-a, is:

From expression (1)′: θc-a < (125 – 50)/61.2
< 1.22

From expression (2)′: θc-a < (150 – 50)/61.2 – 1.4/4
< 1.28

Therefore, to satisfy both expressions, the required heatsink must have a thermal resistance less than 1.22°C/W.

This heatsink design example is based on a constant-voltage supply, and should be verified within your specific set environment.