

No. 5180

STK405-090

2ch AF Power Amplifier (Split Power Supply) 50W + 50W min, THD = 10%

### Overview

The STK405-090, a member of the STK405-000 series, is a low-cost, 2-channel audio power amplifier hybrid IC that is ideal for a wide range of stereo sets. It has dedicated  $6\Omega$  output drive, in contrast with the STK401-000 series which supports  $6\Omega/3\Omega$  output drive.

#### **Features**

- · Class B amplifiers
- Output load impedance  $R_L = 6\Omega$  support
- EIAJ-output compatible (f = 1kHz, THD = 10%)
- · Low supply switching shock noise
- Pin assignment grouped into individual blocks of inputs, outputs and supply lines to minimize the adverse effects of pattern layout on operating characteristics
- · External bootstrap circuit not necessary
- · Standby operation possible using external circuit
- Voltage gain VG = 26dB for easy gain distribution within the set
- · Member of 10W/ch to 80W/ch pin-compatible series

## Series Organization

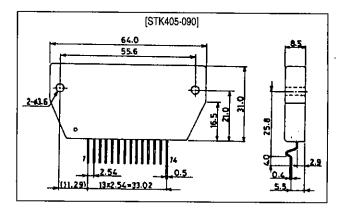
The following devices form a series with differing output capacity. Some of the following devices are under development. Contact your Sanyo sales representative if you require more detailed information.

Type No.	Output power	Supply voltage [V]		
		V <sub>CC</sub> max	V <sub>cc</sub>	
STK405-010	10W + 10W	±26.0	±14.0	
STK405-030	20W + 20W	±30.5	±18.5	
STK405-050	30W + 30W	±34.5	±22.0	
STK405-070	40W + 40W	±39.0	±25.0	
STK405-090	50W + 50W	±42.0	±26.5	
STK405-100	60W + 60W	±45.0	±29.0	
STK405-110	70W + 70W	±50.0	±31.0	
STK405-120	80W + 80W	±52.5	±33.0	

### **Package Dimensions**

unit: mm

4158



### **Specifications**

### Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit	
Maximum supply voltage	V <sub>CC</sub> max		±42	٧	
Thermal resistance	θј-с	Per power transistor	2.7	°C/W	
Junction temperature	Tj		150	°C	
Operating substrate temperature	Tc		125	°C	
Storage temperature	Tstg		-30 to +125	°C	
Available time for load short-circuit	t <sub>s</sub>	$V_{CC} = \pm 26.5V$ , $R_L = 6\Omega$ , $f = 50Hz$ , $P_O = 50W$	1	s	

# Operating Characteristics at Ta = 25°C, $R_L = 6\Omega$ (noninductive load), $Rg = 600\Omega$ , VG = 26dB

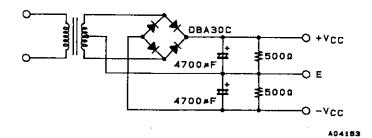
Parameter	Symbol	Conditions	min	typ	max	Unit
Quiescent current	Icco	V <sub>CC</sub> = ±34.0V, no load	-	12	20	mA
Output power	Po	V <sub>CC</sub> = ±26.5V, f = 1kHz, THD = 10.0%	50	-	-	W
Total harmonic distortion	THD	$V_{CC} = \pm 26.5 \text{V}, f = 1 \text{kHz}, P_0 = 5.0 \text{W}$	_	0.04	0.1	%
Frequency response	f <sub>L</sub> , f <sub>H</sub>	$V_{CC} = \pm 26.5V$ , $P_0 = 1.0W$ , $^{+0}_{-3}$ dB	-	20 to 50k		Hz
Input impedance	r <sub>l</sub>	$V_{CC} = \pm 26.5 \text{V}, f = 1 \text{kHz}, P_O = 1.0 \text{W}$	_	55	-	kΩ
Output noise voltage	V <sub>NO</sub>	$V_{CC} = \pm 34.0V$ , Rg = $10k\Omega$	-	-	1.2	mVrms
Neutral voltage	V <sub>N</sub>	V <sub>CC</sub> = ±34.0V	-100	0	+100	mV

All tests are measured using a regulated voltage supply unless otherwise specified.

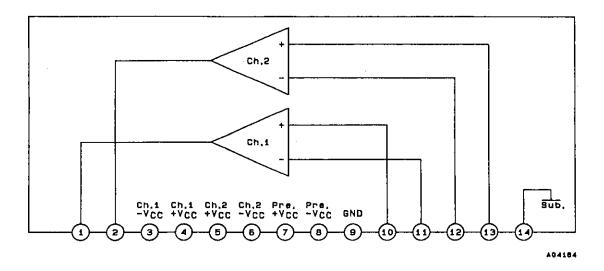
Available time for load short-circuit and output noise voltage are measured using the transformer supply specified below.

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.

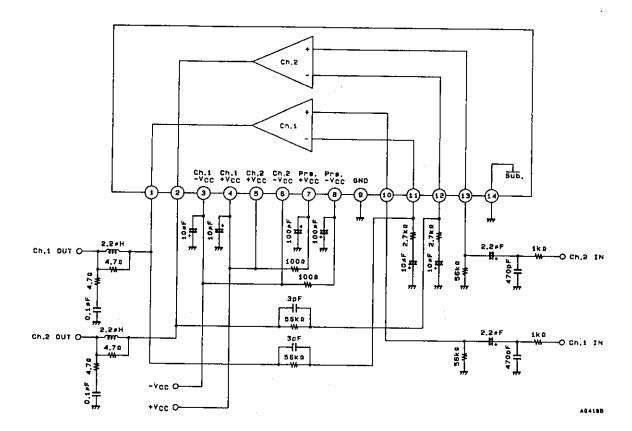
### Specified Transformer Supply (RP-25 or Equivalent)



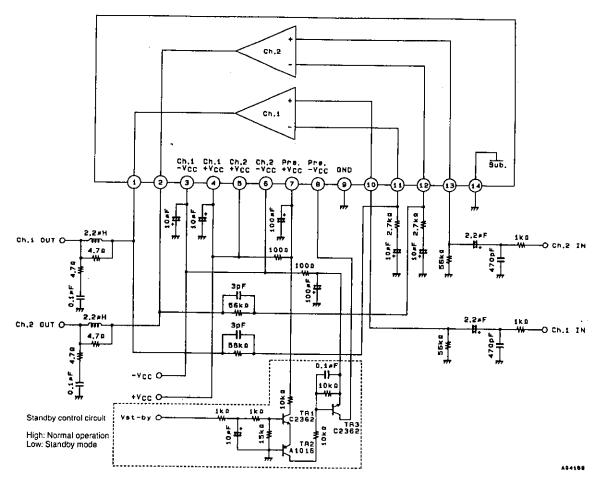
# **Block Diagram**



## **Test Circuit**



## Sample Application Circuit (Standby Mode Supported)



### **Heatsink Design Considerations**

The heatsink thermal resistance,  $\theta$ c-a, required to dissipate the STK405-090 device total power dissipation, Pd, is determined as follows:

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

$$Pd \times \theta c - a + Ta < 125^{\circ}C$$
....(1)

where Ta is the guaranteed maximum ambient temperature.

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

$$Pd \times \theta c - a + Pd/N \times \theta j - c + Ta < 150^{\circ}C$$
 .....(2)

where N is the number of power transistors and  $\theta$ j-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  $\theta$ c-a the subject.

$$\theta c-a < (125 - Ta)/Pd$$
.....(1)'

$$\theta c-a < (150 - Ta)/Pd - \theta j-c/N \dots (2)'$$

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: V<sub>CC</sub>
- Load resistance: R<sub>L</sub>
- Guaranteed maximum ambient temperature: Ta

The total device power dissipation when STK405-090  $V_{CC} = \pm 26.5 V$  and  $R_L = 6 \Omega$ , for a continuous sine wave signal, is a maximum of 48W, as shown in the Pd— $P_O$  characteristic graph.

When estimating the power dissipation for an actual audio signal input, the rule of thumb is to select Pd corresponding to  $1/10 P_0$  max (within safe limits) for a continuous sine wave input. For example,

$$Pd = 34.5W \text{ (for } 1/10 P_0 \text{ max} = 5W)$$

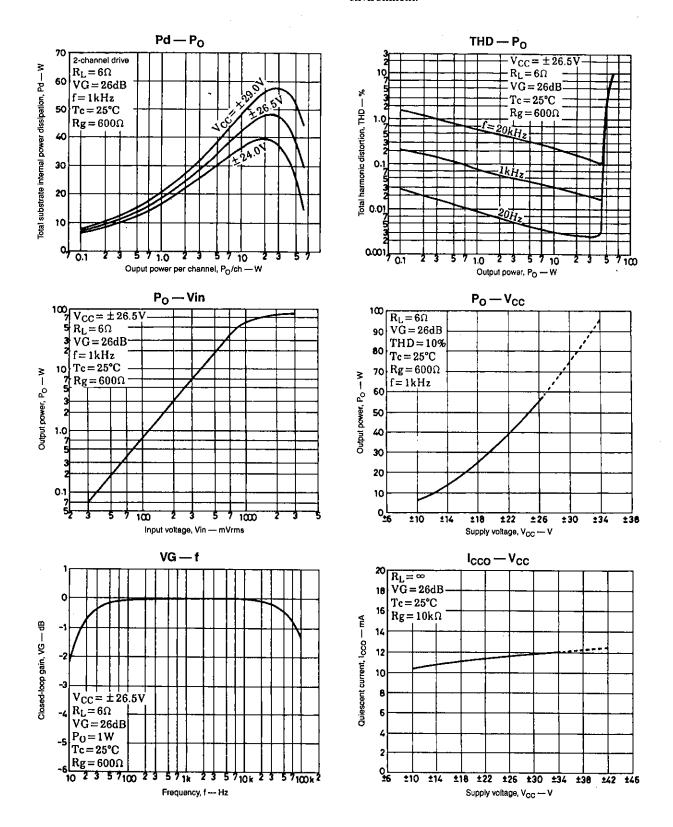
The STK405-090 has 4 power transistors, and the thermal resistance per transistor,  $\theta$ j-c, is 2.7°C/W. If the guaranteed maximum ambient temperature, Ta, is 50°C, then the required heatsink thermal resistance,  $\theta$ c-a, is:

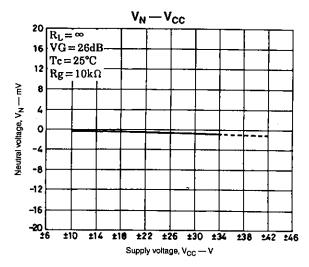
From expression (1)':  $\theta c-a < (125-50)/34.5$ 

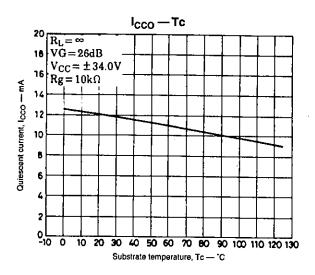
From expression (2)':  $\theta$ c-a < (150 – 50)/34.5 – 2.7/4 < 2.22

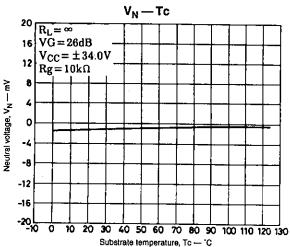
Therefore, to satisfy both expressions, the required heatsink must have a thermal resistance less than 2.17°C/W.

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









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