Ordering number: EN 5174

Thick Film Hybrid IC

SANYO

No. 5174

STK405-030

2ch AF Power Amplifier (Split Power Supply) 20W + 20W min, THD = 10%

Overview

The STK405-030, 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 6Ω output drive, in contrast with the STK401-000 series which supports 6Ω/3Ω output drive.

Features

- Class B amplifiers
- Output load impedance R_L = 6Ω 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

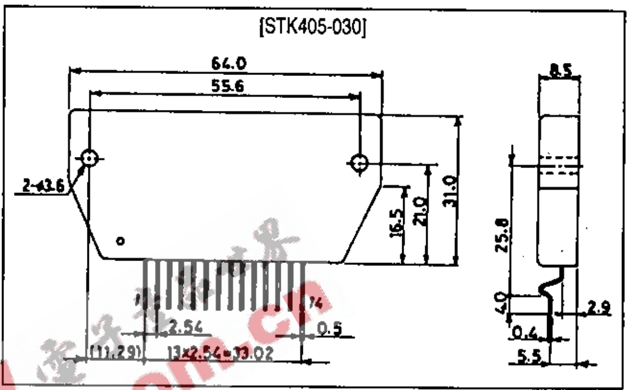
The following devices form a series with differing output capacity. Some of the following devices are under development. Contact your Sanyo sales representative if you require more detailed information.

Type No.	Output power	Supply voltage [V]	
		V_{CC} max	V_{CC}
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



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Specifications

Maximum Ratings at Ta = 25°C

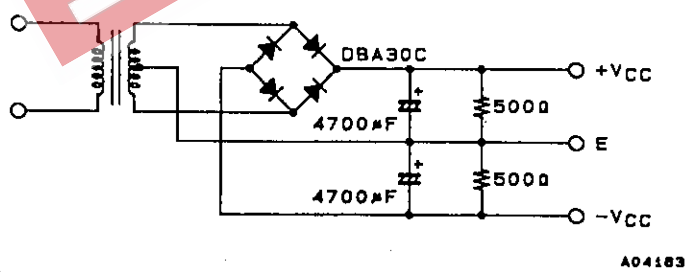
Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		±30.5	V
Thermal resistance	θj-c	Per power transistor	3.4	°C/W
Junction temperature	Tj		150	°C
Operating substrate temperature	Tc		125	°C
Storage temperature	Tstg		–30 to +125	°C
Available time for load short-circuit	t_s	V_{CC} = ±18.5V, R_L = 6Ω, f = 50Hz, P_O = 20W	1	s

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

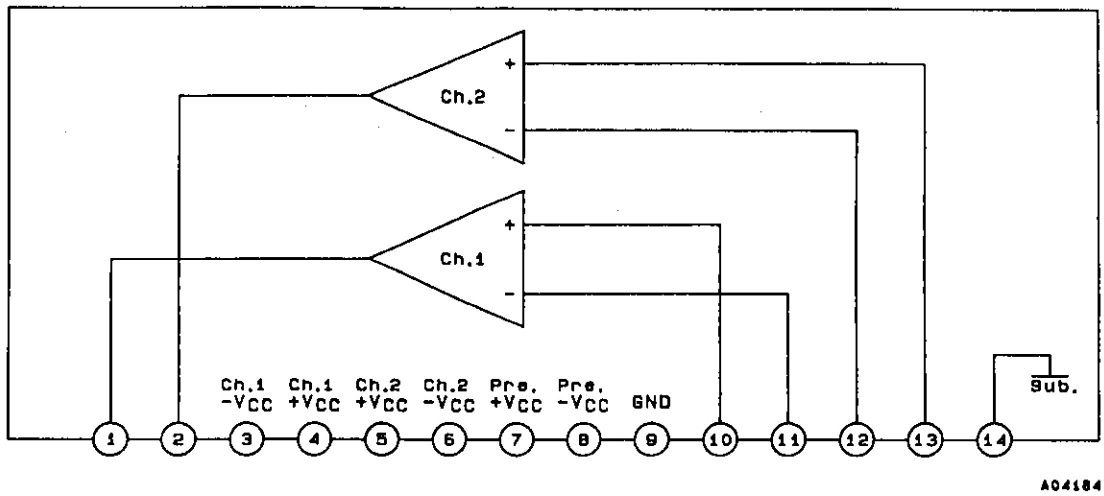
Parameter	Symbol	Conditions	min	typ	max	Unit
Quiescent current	I_{CCO}	V_{CC} = ±24.0V, no load	–	12	20	mA
Output power	P_O	V_{CC} = ±18.5V, f = 1kHz, THD = 10.0%	20	–	–	W
Total harmonic distortion	THD	V_{CC} = ±18.5V, f = 1kHz, P_O = 5.0W	–	0.04	0.1	%
Frequency response	f_L, f_H	V_{CC} = ±18.5V, P_O = 1.0W, $^{+0}_{-3}$dB	–	20 to 50k	–	Hz
Input impedance	r_i	V_{CC} = ±18.5V, f = 1kHz, P_O = 1.0W	–	55	–	kΩ
Output noise voltage	V_{NO}	V_{CC} = ±24.0V, Rg = 10kΩ	–	–	1.2	mVrms
Neutral voltage	V_N	V_{CC} = ±24.0V	–100	0	+100	mV

Notes.
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.

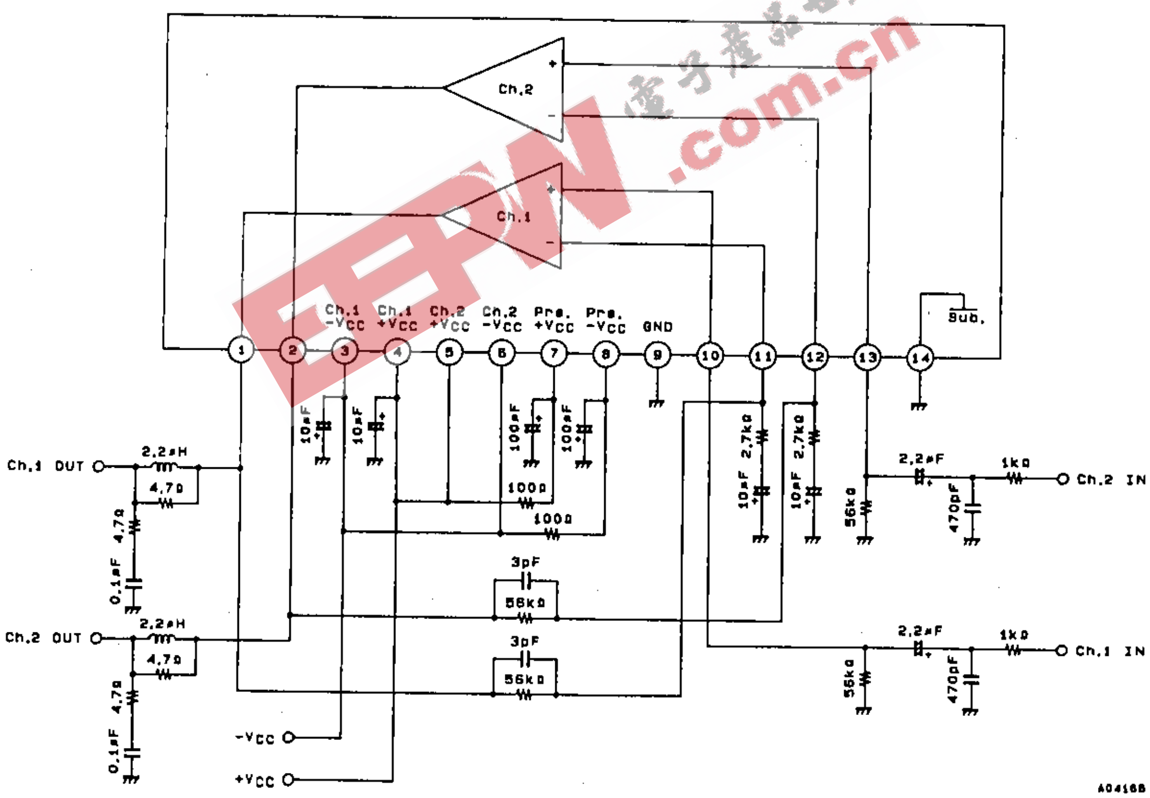
Specified Transformer Supply (RP-22 or Equivalent)



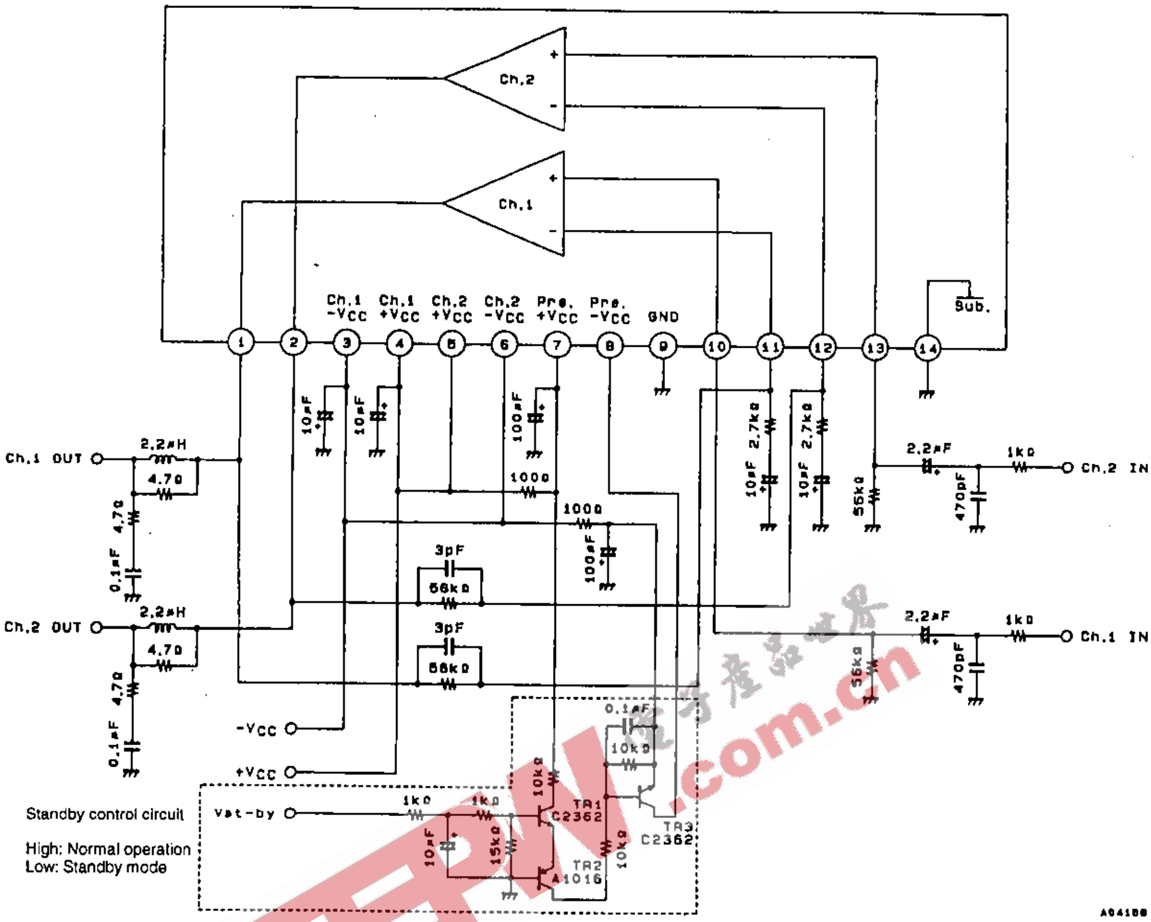
Block Diagram



Test Circuit



Sample Application Circuit (Standby Mode Supported)



Heatsink Design Considerations

The heatsink thermal resistance, θc-a, required to dissipate the STK405-030 device total power dissipation, Pd, is determined as follows:

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

$$Pd \times \theta c\text{-}a + Ta < 125°C \quad (1)$$

where Ta is the guaranteed maximum ambient temperature.

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

$$Pd \times \theta c\text{-}a + Pd/N \times \theta j\text{-}c + Ta < 150°C \quad (2)$$

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.

$$\theta c\text{-}a < (125 - Ta)/Pd \quad (1)'$$

$$\theta c\text{-}a < (150 - Ta)/Pd - \theta j\text{-}c/N \quad (2)'$$

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_{CC}
- Load resistance: R_L
- Guaranteed maximum ambient temperature: Ta

The total device power dissipation when STK405-030 V_{CC} = ±18.5V and R_L = 6Ω, for a continuous sine wave signal, is a maximum of 23.5W, 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_O max (within safe limits) for a continuous sine wave input. For example,

Pd = 16W (for 1/10 P_O max = 2W)

The STK405-030 has 4 power transistors, and the thermal resistance per transistor, θj-c, is 3.4°C/W. If the guaranteed maximum ambient temperature, Ta, is 50°C, then the required heatsink thermal resistance, θc-a, is:

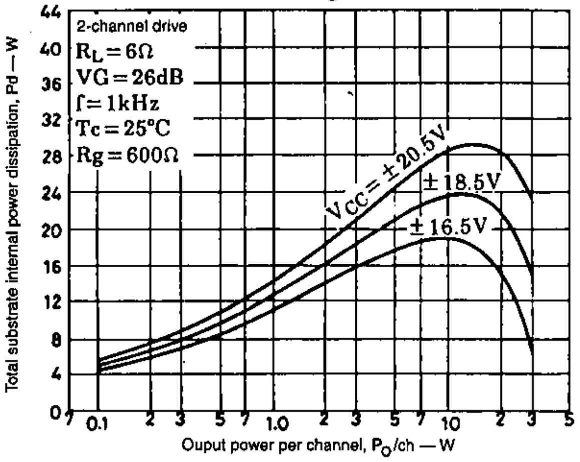
From expression (1)′: θc-a < (125 – 50)/16
< 4.68

From expression (2)′: θc-a < (150 – 50)/16 – 3.4/4
< 5.40

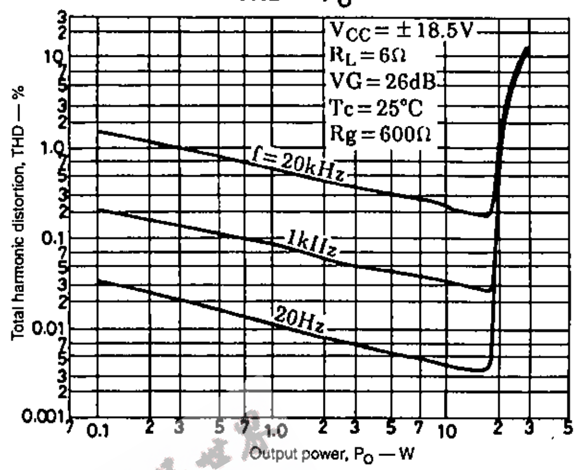
Therefore, to satisfy both expressions, the required heat-sink must have a thermal resistance less than 4.68°C/W.

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

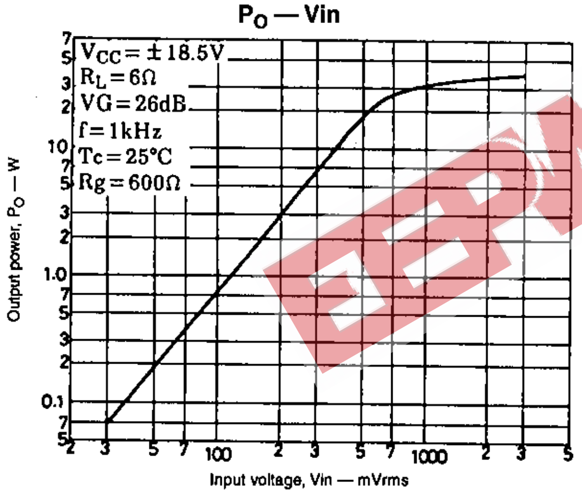
Pd — P_O



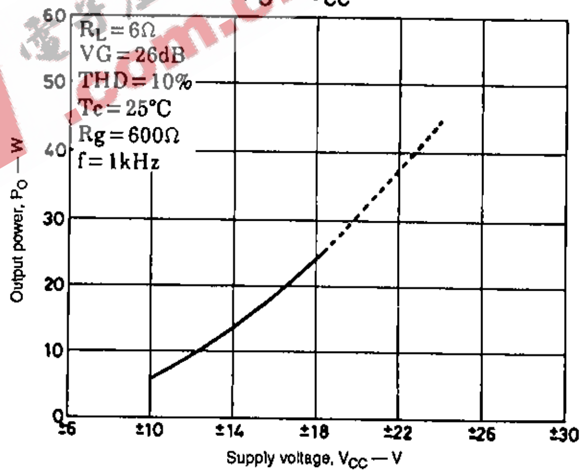
THD — P_O



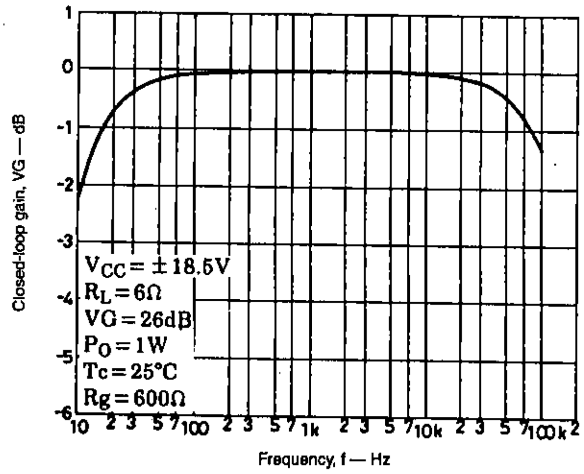
P_O — Vin



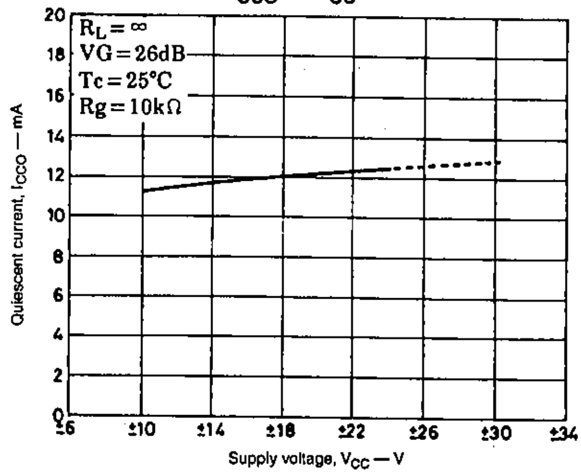
P_O — V_{CC}

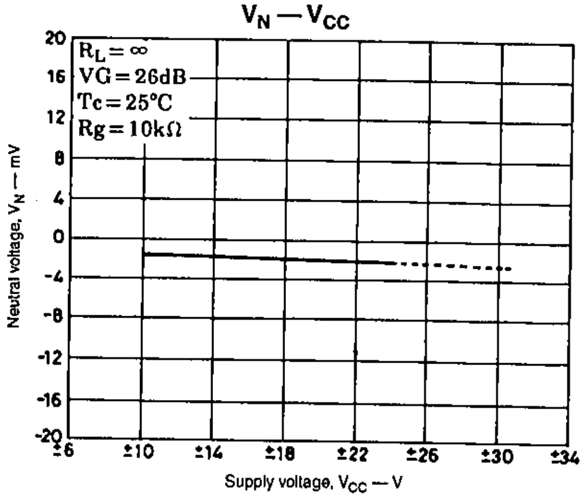


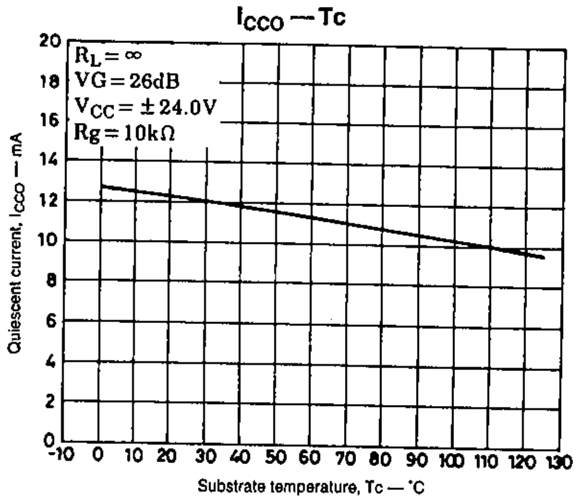
VG — f

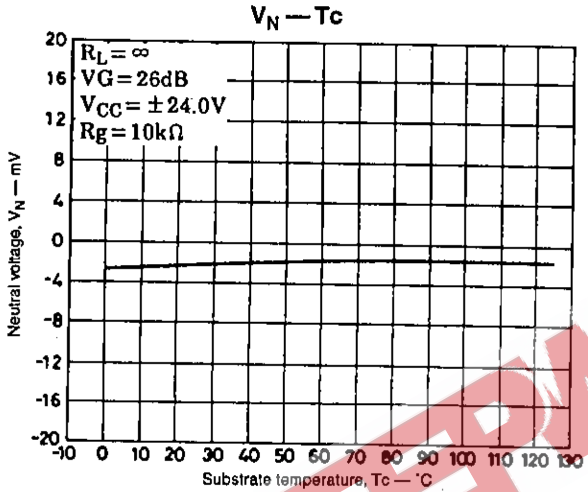


I_{CCO} — V_{CC}




VN — VCC
RL = ∞
VG = 26dB
Tc = 25°C
Rg = 10kΩ
Neutral voltage, VN — mV
Supply voltage, VCC — V
20
16
12
8
4
0
-4
-8
-12
-16
-20
±6
±10
±14
±18
±22
±26
±30
±34


ICCO — Tc
RL = ∞
VG = 26dB
VCC = ±24.0V
Rg = 10kΩ
Quiescent current, ICCO — mA
Substrate temperature, Tc — °C
20
18
16
14
12
10
8
6
4
2
0
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130


VN — Tc
RL = ∞
VG = 26dB
VCC = ±24.0V
Rg = 10kΩ
Neutral voltage, VN — mV
Substrate temperature, Tc — °C
20
16
12
8
4
0
-4
-8
-12
-16
-20
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130