Ordering number : ENN7340

Thick-Film Hybrid IC

STK402-950

Class AB Audio Power Amplifier IC 30 W × 5 Channels

Overview

The STK402-900 series products are audio power amplifier hybrid ICs that consist of optimally-designed discrete component power amplifier circuits that have been miniaturized using SANYO's unique insulated metal substrate technology (IMST). The adoption of a newly-developed low thermal resistance substrate allows this product to integrate five power amplifier channels in a single compact package.

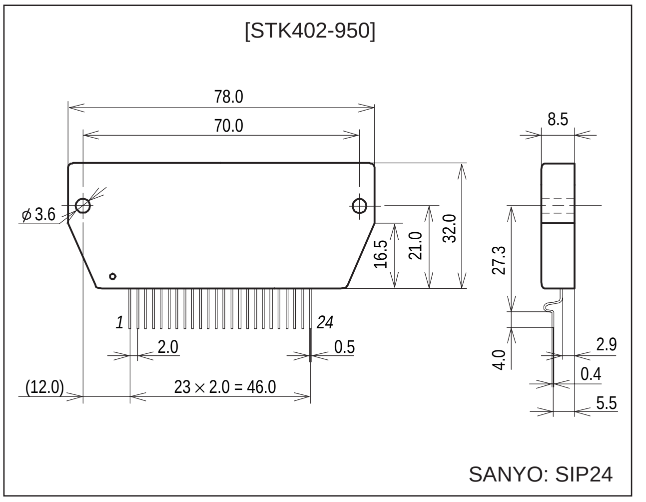
Features

- Series of pin compatible power amplifiers ranging from 20 W/ch to 45 W/ch (10%/1 kHz) devices. The same printed circuit board can be used depending on the output power grade.
- The pin arrangement is compatible with that of the 2-channel STK403-000 series and 3-channel for STK403-200 series.
- Miniature packages
  — 15 W/ch to 45 W/ch (THD = 0.4%, f = 20 Hz to 20 kHz); 78.0 mm × 32.0 mm × 8.5 mm *
  *: Not including the pins.
- Output load impedance: R_L = 6 Ω
- Allowable load shorted time: 0.3 seconds
- Supports the use of standby, muting, and load shorting protection circuits.

Package Dimensions

unit: mm

4200-SIP24



Series Organization

These products are organized as a series based on their output capacity.

Item	Type No.			
	STK402-920	STK402-930	STK402-940	STK402-950
Output 1 (10%/1 kHz)	20 W × 5 ch	30 W × 5 ch	40 W × 5 ch	45 W × 5 ch
Output 2 (0.4%/20 Hz to 20 kHz)	15 W × 5 ch	20 W × 5 ch	25 W × 5 ch	30 W × 5 ch
Maximum supply voltage (No signal)	±30 V	±36 V	±38 V	±40 V
Maximum supply voltage (6 Ω)	±28 V	±34 V	±36 V	±38 V
Recommended supply voltage (6 Ω)	±20 V	±23 V	±26 V	±28 V
Package	78.0 mm × 32.0 mm × 8.5 mm			

Specifications

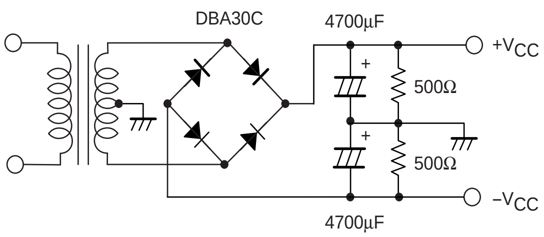
Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage (No signal)	V_{CC} max(0)		±40	V
Maximum supply voltage	V_{CC} max(1)	R_L = 6 Ω	±38	V
Thermal resistance	θ j-c	Per power transistor	3.6	°C/W
Junction temperature	Tj max	Both the Tj max and the Tc max conditions must be met.	150	°C
Operating IC substrate temperature	Tc max		125	°C
Storage temperature	Tstg		–30 to +125	°C
Allowable load shorted time *4	ts	V_{CC} = ±28.0 V, R_L = 6 Ω, f = 50 Hz, P_O = 30 W	0.3	s

Operating Characteristics at Tc = 25°C, R_L = 6 Ω (noninductive load), Rg = 600 Ω, VG = 30 dB

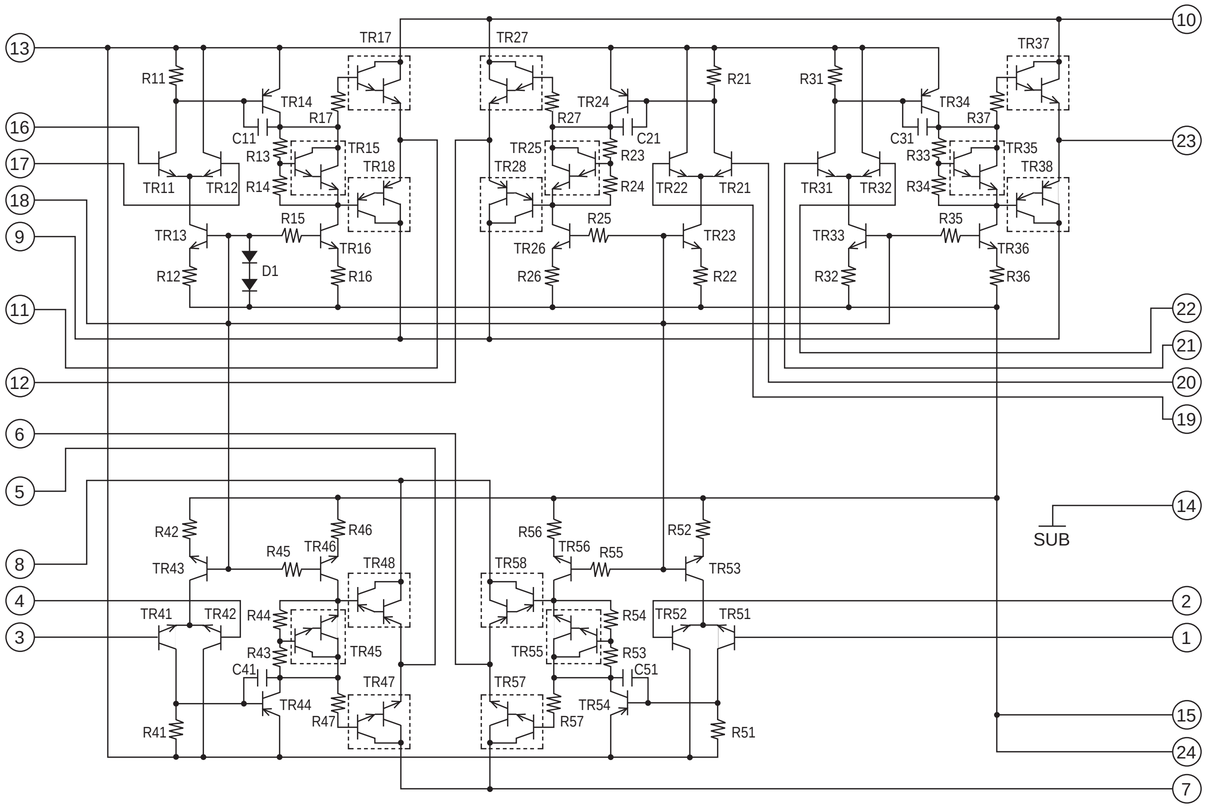
Parameter	Symbol	Conditions*1					Ratings			Unit
		V_{CC} (V)	f (Hz)	P_O (W)	THD (%)		min	typ	max	
Output power *1	P_O (1)	±28.0	20 to 20 k		0.4		27	30		W
	P_O (2)	±28.0	1 k		10			45		
Total harmonic distortion *1	THD (1)	±28.0	20 to 20 k	1.0					0.4	%
	THD (2)	±28.0	1 k	5.0				0.01		
Frequency characteristics *1	f_L, f_H	±28.0		1.0		+0 –3 dB		20 to 50 k		Hz
Input impedance	ri	±28.0	1 k	1.0				55		kΩ
Output noise voltage *3	V_{NO}	±34.0				Rg = 2.2 kΩ			1.2	mVrms
Quiescent current	I_{CCO}	±34.0					70	95	120	mA
Neutral voltage	V_N	±34.0					–70	0	+70	mV

Notes: 1. 1 ch drive
2. Unless otherwise noted, use a constant-voltage supply for the power supply used during inspection.
3. The output noise voltage values shown are peak values read with a VTVM. However, an AC stabilized (50 Hz) power supply should be used to minimize the influence of AC primary side flicker noise on the reading.
4. Use the transformer power supply circuit shown in the figure below for allowable load shorted time measurement and output noise voltage measurement.

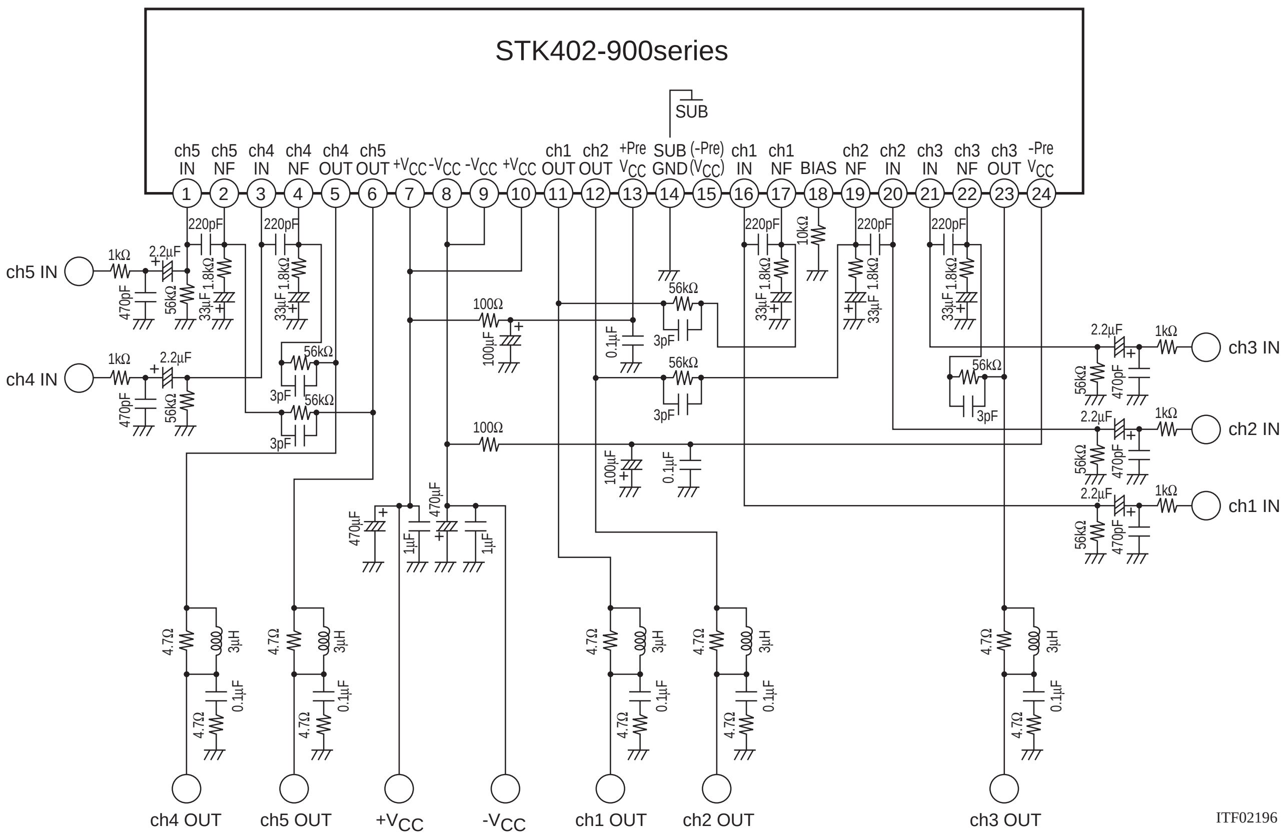


Designated Transformer Power Supply (RP-25 equivalent)

Internal Equivalent Circuit



Sample Application Circuit



Thermal Design Example

The heat sink thermal resistance, θc-a, required to handle the total power dissipated within this hybrid IC is determined as follows.

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

Pd × θc-a + Ta < 125°C ... (1)

Ta: Guaranteed ambient temperature for the end product.

Condition 2: The junction temperature of each individual transistor must not exceed 150°C.

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

N: Number of power transistors

θj-c: Thermal resistance per power transistor

We take the power dissipation in the power transistors to be Pd evenly distributed across those N power transistors.

If we solve for θc-a in equations (1) and (2), we get the following inequalities.

θc-a < (125 – Ta)/Pd ... (1)’

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

Values that satisfy both these inequalities at the same time are the required heat sink thermal resistance values.

Determining the following specifications allows us to determine the required heat sink thermal resistance from inequalities (1)’ and (2)’.

- Supply voltage: V_{CC}
- Load resistance: R_L
- Guaranteed ambient temperature: Ta

Example:

Assume that the IC supply voltage, V_{CC}, is ±28 V, R_L is 6 Ω, and that the signal is a continuous sine wave. In this case, from the Pd – P_O characteristics, the maximum power will be 135 W for a signal with a frequency of 1 kHz.

For actual music signals, it is usual to use a Pd of 1/8 of $P_O$max, which is the power estimated for continuous signals in this manner. (Note that depending on the particular safety standard used, a value somewhat different from the value of 1/8 used here may be used.)

That is:

Pd = 85 W (when 1/8 $P_O$max is 3.8 W)

The number, N, of power transistors in the hybrid IC's audio amplifier block is 10. Since the thermal resistance, θc-a, per transistor is 3.6°C/W, the required heat sink thermal resistance, θc-a, for a guaranteed ambient temperature of 50°C will be as follows.

From inequality (1)’: θc-a < (125 – 50)/85

< 0.88

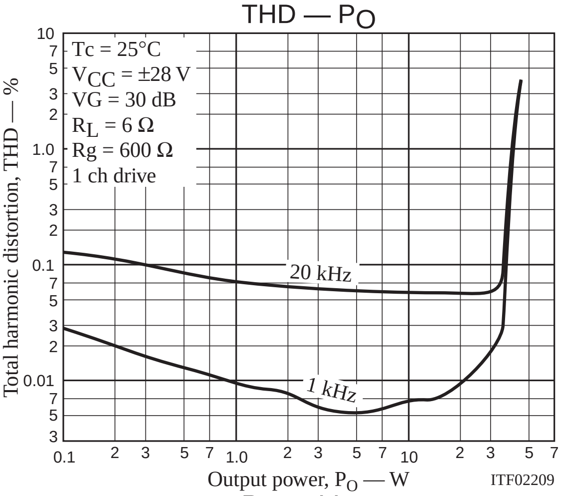
From inequality (2)’: θc-a < (150 – 50)/85 – 3.6/10

< 0.81

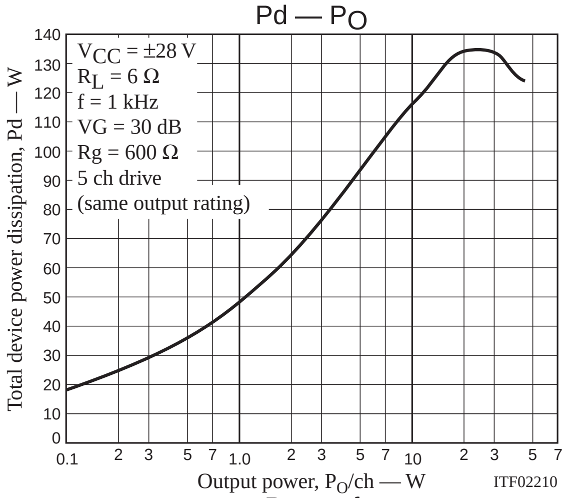
Therefore, the thermal resistance that satisfies both these expressions at the same time is 0.81°C/W.

Note that this thermal design example assumes the use of a constant-voltage power supply, and is only provided as an example for reference purposes. Thermal designs must be tested in an actual end product.

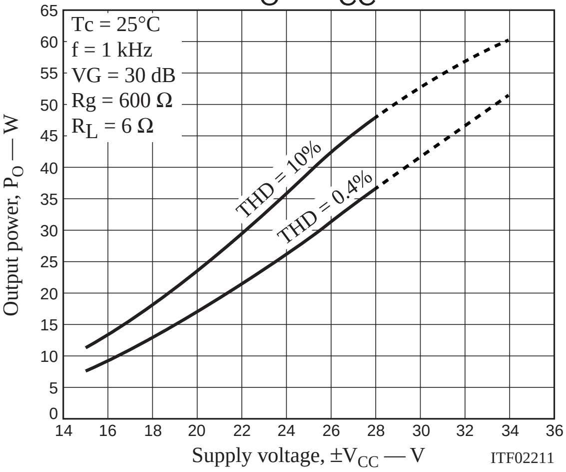
THD — P_O



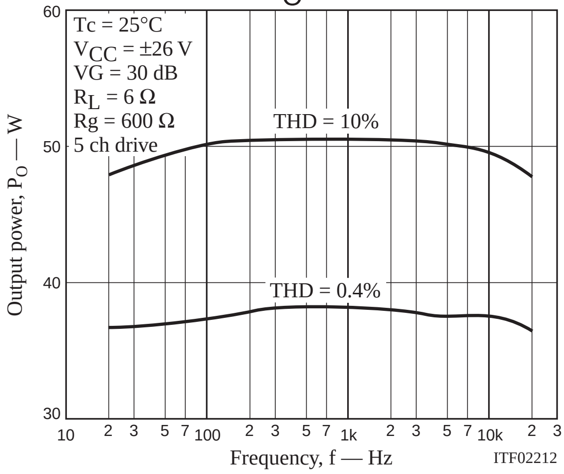
Pd — P_O



P_O — V_{CC}



P_O — f



This catalog provides information as of December, 2003. Specifications and information herein are subject to change without notice.