


SANYO Semiconductors

DATA SHEET

Thick-Film Hybrid IC

STK404-140S — One-Channel Class AB Audio Power Amplifier IC 120W

Overview

The STK404-000S 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 series of devices to be provided in miniature packages significantly more compact than earlier Sanyo products with similar specifications.

Features

- Series of pin compatible power amplifiers ranging from 45W to 180W (10%/1kHz) devices. The same printed circuit board can be used depending on the output power grade.
- Miniature packages
 - 30W to 40W (THD=0.4%, f=20Hz to 20kHz); 44.0mm × 25.6mm × 8.5mm *
 - 50W to 80W (THD=0.4%, f=20Hz to 20kHz); 46.6mm × 25.5mm × 8.5mm *
 - 100W to 120W (THD=0.4%, f=20Hz to 20kHz); 59.2mm × 25.5mm × 8.5mm *
- *: Not including the pins.
- Output load impedance: $R_L=6\Omega$
- Allowable load shorted time: 0.3 seconds
- Built-in thermal protection circuit
- Supports the use of standby, muting, and load shorting protection circuits.

Series Organization

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

Item	Type No.						
	STK404-050S	STK404-070S	STK404-090S	STK404-100S	STK404-120S	STK404-130S	STK404-140S
Output 1 (0.4%/20Hz to 20kHz)	30W	40W	50W	60W	80W	100W	120W
Output 2 (10%/1kHz)	45W	60W	80W	90W	120W	150W	180W
Maximum supply voltage (6Ω)	±37V	±43V	±46V	±51V	±59V	±64V	±73V
Recommended supply voltage (6Ω)	±26V	±30V	±32V	±35V	±41V	±45V	±51V
Remarks	Built-in thermal protection circuit						
Package	44.0mm × 25.6mm × 8.5mm		46.6mm × 25.5mm × 8.5mm			59.2mm × 25.5mm × 8.5mm	

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Thermal Design Example

If we define P_d , the total power dissipation on the board when this hybrid IC is in operation, the heat sink thermal resistance, θ_{c-a} , is determined as follows:

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

$$P_d \times \theta_{c-a} + T_a < 125^\circ\text{C} \dots (1)$$

T_a : Guaranteed ambient temperature for the end product.

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

$$P_d \times \theta_{c-a} + P_d/N \times \theta_{j-c} + T_a < 150^\circ\text{C} \dots (2)$$

N : Number of power transistors

θ_{j-c} : Thermal resistance per power transistor

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

If we solve for θ_{c-a} in equations (1) and (2), we get the following inequalities:

$$\theta_{c-a} < (125 - T_a)/P_d \dots (3)$$

$$\theta_{c-a} < (150 - T_a)/P_d - \theta_{j-c}/N \dots (4)$$

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

Example:

For actual music signals, it is usual to use a P_d of 1/8 of P_{Omax} , 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.)

When $V_{CC} = \pm 51\text{V}$ and $R_L = 6\Omega$, we get the following expression for the total power dissipation on the board, P_d :

$$P_d = 57 \text{ W (when } 1/8 P_{Omax} \text{ is } 15 \text{ W)} \dots (5)$$

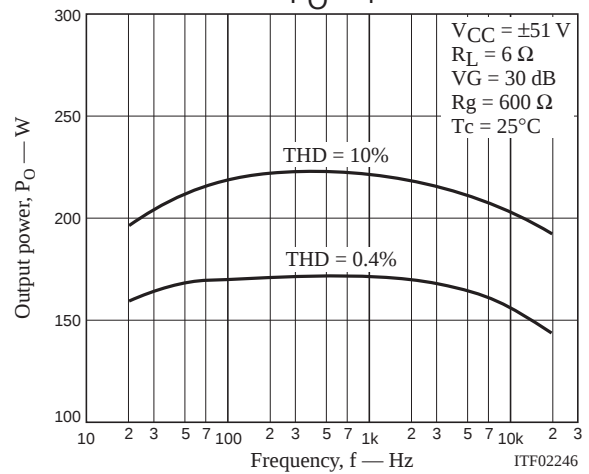
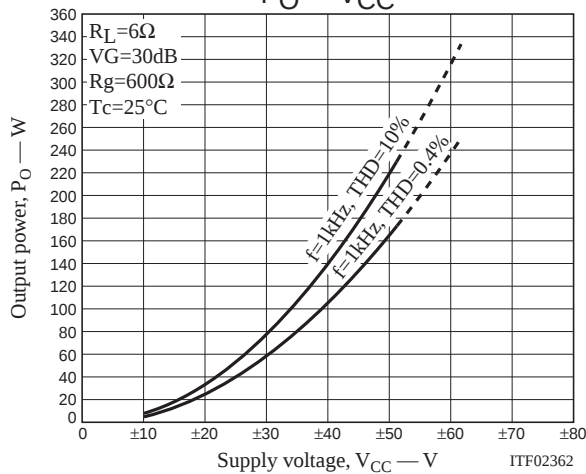
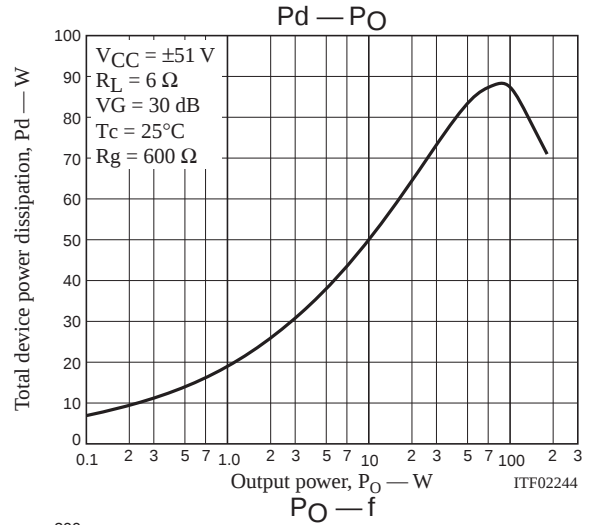
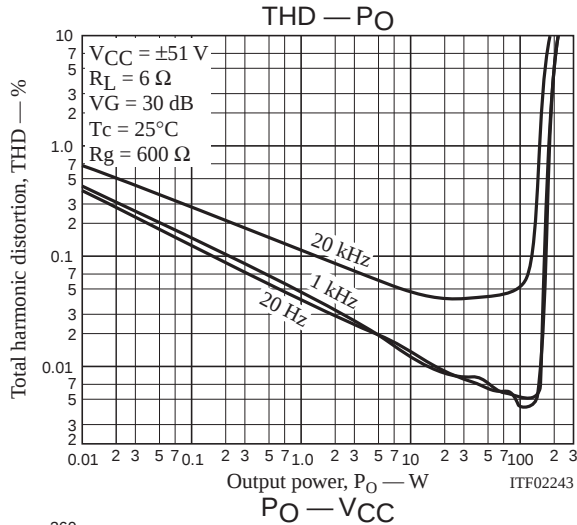
The number, N , of power transistors in the hybrid IC's audio amplifier block is 2. Since the thermal resistance, θ_{j-c} , per transistor is 1.2°C/W, the required heat sink thermal resistance, θ_{c-a} , for a guaranteed ambient temperature of 50°C will be as follows:

$$\text{From inequality (3): } \theta_{c-a} < (125 - 50)/57 = 1.31 \dots (6)$$

$$\text{From inequality (4): } \theta_{c-a} < (150 - 50)/57 - 1.2/2 = 1.15 \dots (7)$$

Therefore, the thermal resistance that satisfies both these expressions (6,7) at the same time is 1.15°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.



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