

SANYO Semiconductors DATA SHEET

STK404-100SC-E - 1-channel class AB audio power IC, 90W

Overview

The STK404-100SC-E series is hybrid IC for the audio power amplifier that mounts discrete components as the audio power amplifier circuit in small space using the original Insulated Metal Substrate Technology IMST. The compact package has been achieved by adopting the low thermal resistance substrate (our conventional model kind ratio).

Applications

• Audio power amplifiers.

Features

- Pin-to-pin compatible outputs ranging from 90W to 180W
- Miniature package (46.6mm×25.5mm×8.5mm, 59.2mm×25.5mm×8.5mm)
- Output load impedance $R_L=6\Omega$ supported.
- Allowable load shorted time: 0.3s
- Allows the use of predesigned applications for standby, mute, and the load short protection circuit.

Series Models

| | STK404-100SC-E | STK404-120SC-E | STK404-130SC-E | STK404-140SC-E |
|---|----------------|----------------|----------------|----------------|
| Output 1 (10%/1kHz) | 90W×1ch | 120W×1ch | 150W×1ch | 180W×1ch |
| Output 2 (0.4%/20Hz to 20kHz) | 60W×1ch | 80W×1ch | 100W×1ch | 120W×1ch |
| Maximum rated V _{CC} max(no sig.) | ±55V | ±65V | ±70V | ±78V |
| Maximum rated V_{CC} (6 Ω) | ±51V | ±59V | ±64V | ±73V |
| Recommended operating V _{CC} (6 Ω) | ±35V | ±41V | ±45V | ±51V |
| Dimensions (excluding pin height) | 46.6mm×25. | 5mm×8.5mm | 59.2mm×25. | 5mm×8.5mm |

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Specifications

Absolute Maximum Ratings at Ta = 25°C (excluding rated temperature items), Tc=25°C unless otherwise specified

| Parameter | Symbol | Conditions | Ratings | Unit |
|------------------------------------|----------------------|--|-------------|------|
| Power supply voltage 1 | V _{CC} max1 | Non-signal | ±55 | V |
| Power supply voltage 2 | V _{CC} max2 | Signal, RL=6 Ω | ±51 | V |
| Thermal detector maximum voltage | Vp | 1-4pin | 16 | V |
| Thermal detector maximum current | lp | 1-4pin | 30 | mA |
| Thermal resistance | өј-с | Per power transistor | 1.7 | °C/W |
| Junction temperature | Tj max | Should satisfy Tj max and Tc max | 150 | °C |
| Operating IC substrate temperature | Tc max | | 125 | °C |
| Storage temperature | Tstg | | -30 to +125 | °C |
| Allowable load shorted time *4 | ts | $V_{CC}=\pm 35V$, $R_{L}=6\Omega$, f=50Hz, $P_{O}=60W$ | 0.3 | S |

Electrical Characteristics at $Tc=25^{\circ}C$, $R_{L}=6\Omega$, $R_{g}=600\Omega$, VG=30dB, non-inductive load R_{L} , unless otherwise specified

| | | Conditions *2 | | | | Ratings | | | | |
|---------------------------------------|--------------------|------------------------|-----------|-----------------------|------------|---------|------|-----------|------|-------|
| Parameter | Symbol | V _{CC} (V) | f (Hz) | P _O (W) | THD (%) | | min | typ | max | unit |
| Output power *1 | P _O (1) | ±35 | 20 to 20k | | 0.4 | | 60 | | | 10/ |
| | P _O (2) | ±35 | 1k | | 10 | | | 90 | | vv |
| Frequency characteristics *1 | fL, fH | ±35 | | 1.0 | | +0 -3dB | 2 | 20 to 20k | | Hz |
| Input impedance | ri | ±35 | 1k | 1.0 | | | | 55 | | kΩ |
| Output noise voltage *3 | V _{NO} | ±42 | | | | Rg=10kΩ | | 1.2 | | mVrms |
| Output neutral voltage | VN | ±42 | | | | | -100 | 0 | +100 | mV |
| Quiescent current | Icco | ±42 | | | | No load | | | 50 | mA |
| Thermal detector resistance | Rp | Tp=25°C, 1-4pin | | | | 470 | | Ω | | |
| Thermal detector operate temperrature | Тр | Rp=4.7kΩ, 1-4pin 145 | | | | °C | | | | |

[Remarks]

*1. Unless otherwise specified, use a constant-voltage power supply to supply power when inspections are carried out.

*2. Thermal Detector temperature (+145°C±5°C) indicates the value at unusual operation, therefore, does not indicate the guaranteed value at usual operation. Thermal Detector is PRF21series (AS characteristic) manufactured by MURATA.

*3. The output noise voltage values shown are peak values read with a VTVM. However, an AC stabilized (50Hz) power supply should be used to minimize the influence of AC primary side flicker noise on the reading.

*4. Use the designated transformer power supply circuit shown in the figure below for the measurement of allowable load shorted time and output noise voltage.

- *5. Thermal design must be implemented based on the conditions under which the customer's end products are expected to operate on the market.
- *6 Weight of 1 HIC: 12.6g

Outer carton dimensions (W×L×H): 420mm×233mm×277mm



Package Dimensions





Equivalent Circuit



Application Circuit



PCB Layout Example



PCB Parts List

| Type(IC1) *1 | STK404-100 | STK404-120 | STK404-130 | STK404-140 |
|--------------------------|---------------------------|---------------------------|---------------|---------------|
| Position of ① pin | Second from the right end | Second from the right end | The right end | The right end |
| Location | | | | |
| R1 | 1kΩ | ←*2 | \leftarrow | \leftarrow |
| R2 | 56kΩ | \leftarrow | \leftarrow | \leftarrow |
| R3 | 1.8kΩ | \leftarrow | \leftarrow | ← |
| R4 | 100Ω/1W | \leftarrow | \leftarrow | \leftarrow |
| R5 | 56kΩ | \leftarrow | \leftarrow | \leftarrow |
| R6 | 4.7kΩ/1W | 4.7kΩ/1W | 5.1kΩ/1W | 8.2kΩ/1W |
| R7 | 4.7kΩ/1W | 4.7kΩ/1W | 5.1kΩ/1W | 8.2kΩ/1W |
| R8 | 0.22Ω/5W | \leftarrow | \leftarrow | \leftarrow |
| R9 | 0.22Ω/5W | \leftarrow | \leftarrow | ← |
| R10 | 4.7Ω/1W | \leftarrow | \leftarrow | \leftarrow |
| R11 | 4.7Ω/1W | \leftarrow | \leftarrow | \leftarrow |
| | | | | |
| C1 | 470pF | \leftarrow | \leftarrow | <i>←</i> |
| C2 | 2.2µF/50V | \leftarrow | \leftarrow | \leftarrow |
| C3 | 10μF/50V | \leftarrow | \leftarrow | ← |
| C4 | 100μF/100V | \leftarrow | \leftarrow | \leftarrow |
| C5 | ЗрF | \leftarrow | \leftarrow | \leftarrow |
| C6 | 100µF/50V | \leftarrow | \leftarrow | \leftarrow |
| C7 | 47µF/100V | \leftarrow | \leftarrow | \leftarrow |
| C8 | 10μF/100V | \leftarrow | \leftarrow | \leftarrow |
| C9 | 10μF/100V | \leftarrow | \leftarrow | \leftarrow |
| C10 | 0.1µF | \leftarrow | \leftarrow | \leftarrow |
| | | | | |
| D1 | short | \leftarrow | \leftarrow | \leftarrow |
| L1 | 2.2μΗ | <i>←</i> | \leftarrow | \leftarrow |
| | | | | |
| J1 | 15mm | \leftarrow | \leftarrow | ← |
| J2 | 10mm | \leftarrow | \leftarrow | \leftarrow |

*1 There is a model from which the sign (S, C, SC etc) is added to the end of the product name.

If it is a product of this output, Parts List is same.

*2 \leftarrow : Same as left

Pin Layout

[STK404-100SC sr Pin Layout]

| 1ch class-AB | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|--|-------------|-------------|----------------------------|----------------------------|-----------------------|------------------|------------------|-----------------------|--------|-------------|------------------|---------------------------------|--------------------------------------|
| | | | 1ch classAB/2.54mm | | | | | | | | | | |
| STK404-100SC-E 90W/JEITA STK404-120SC-E 120W/JEITA | | P T + | I N / C H 1 | N F C H 1 | S U B P T | - P R E | + 1 2 V | + V B O T | N C | V C C | + V C C | 0 U T (C H 1 | O U T / C H 1 |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | - 12 | + 13 |
| | | | | | | 1ch cla | assAB/2 | .54mm | | | | | |
| STK404-130SC-E 150W/JEITA STK404-140SC-E 180W/JEITA | P T - | P T + | I N / C H 1 | N F / C H 1 | S U B P T | - P R E | + 1 2 V | + V B O T | N C | V C C | + V C C | O U T C H 1 - | O U T / C H 1 + |

Characteristic of Evaluation Board





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

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

Values that satisfy these two inequalities at the same time represent the required heat sink thermal resistance. When the following specifications have been stipulated, the required heat sink thermal resistance can be determined from formulas (1)' and (2)'.

| • Supply voltage | VCC |
|-------------------------------------|-----|
| Load resistance | RL |
| • Guaranteed ambient temperature | Та |

[Example]

When the IC supply voltage, $V_{CC}=\pm 35V$ and R_L is 6Ω , the total power dissipation, Pd, within the hybrid IC, will be a maximum of 42W at 1kHz for a continuous sine wave signal according to the Pd-Po characteristics. For the music signals normally handled by audio amplifiers, a value of 1/8P_O max is generally used for Pd as an estimate of the power dissipation based on the type of continuous signal. (Note that the factor used may differ depending on the safety standard used.)

This is:

Pd = 28W (when 1/8PO max = 7.5W).

The number of power transistors in audio amplifier block of these hybrid ICs, N, is 2, and the thermal resistance per transistor, θ j-c, is 1.7°C/W. Therefore, the required heat sink thermal resistance for a guranteed ambient temperature, Ta, of 50°C will be as follows.

| From formula (1)' | θc -a < (125 – 50)/28 |
|-------------------|--------------------------------------|
| | < 2.67 |
| From formula (2)' | θ c-a < (150 - 50)/28 - 1.7/2 |
| | < 2.72 |

Therefore, the value of 2.67°C/W, which satisfies both of these formulae, is the required thermal resistance of the heat sink.

Note that this thermal design example assumes the use of a constant-voltage power supply, and is therefore not a verified design for any particular user's end product.

STK404-000s Stand-by Control & Mute Control Application



STK404-000s Thermal Shut Down Application



No. A1686-8/9

STK404-090, 100, 120 Road-Short & DC Voltage Protect Application



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