Ordering number:ENN*5385

Thick Film Hybrid IC

STK401-290

2ch AF Power Amplifier (Split Power Supply) (50W + 50W min, THD = 0.08%)

Preliminary

Overview

The STK401-290 is a 2-channel audio power amplifier IC that supports 6/3Ω output load impedances. It is fully pin compatible with the 3-channel output devices (STK400-×00 series) and 2-channel output devices (STK401-×00 series). In addition, it supports 6/3Ω output load impedance.

Features

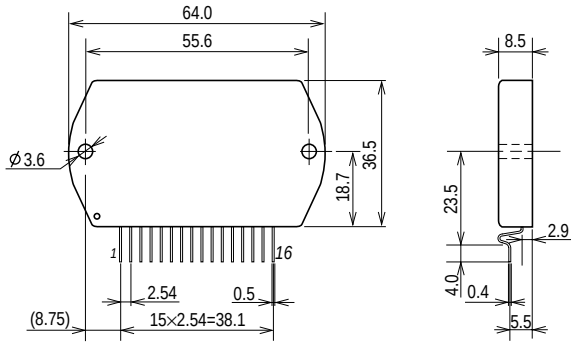
- Pin compatible with the 3-channel output devices (STK400-×00 series) and 2-channel output devices (STK401-×00 series)
- Output load impedance R_L=6/3Ω supported
- Pin configuration grouped into individual blocks of inputs, outputs and supply lines to minimize the adverse effects of pattern layout on operating characteristics.
- Few external components

Package Dimensions

unit:mm

4134

[STK401-290]



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SANYO Electric Co.,Ltd. Semiconductor Company

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

Specifications

Maximum Ratings at Ta = 25˚C

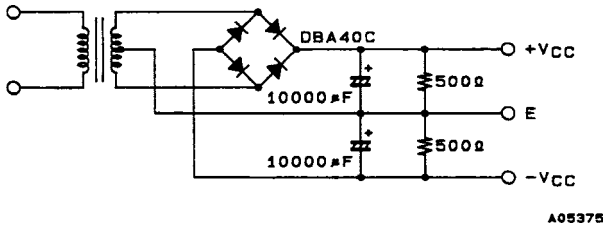
Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		±47	V
Thermal resistance	θ j-c	Per power transistor	1.7	˚C/W
Junction temperature	Tj		150	˚C
Operating substrate temperature	Tc		125	˚C
Storage temperature	Tstg		–30 to +125	˚C
Available time for load short-circuit	t_S	V_{CC}=±32V, R_L=6Ω, f=50Hz, P_O=50W	1	s

Operating Characteristics at Ta = 25˚C, R_L=6Ω (noninductive load), Rg=600Ω, VG=40dB

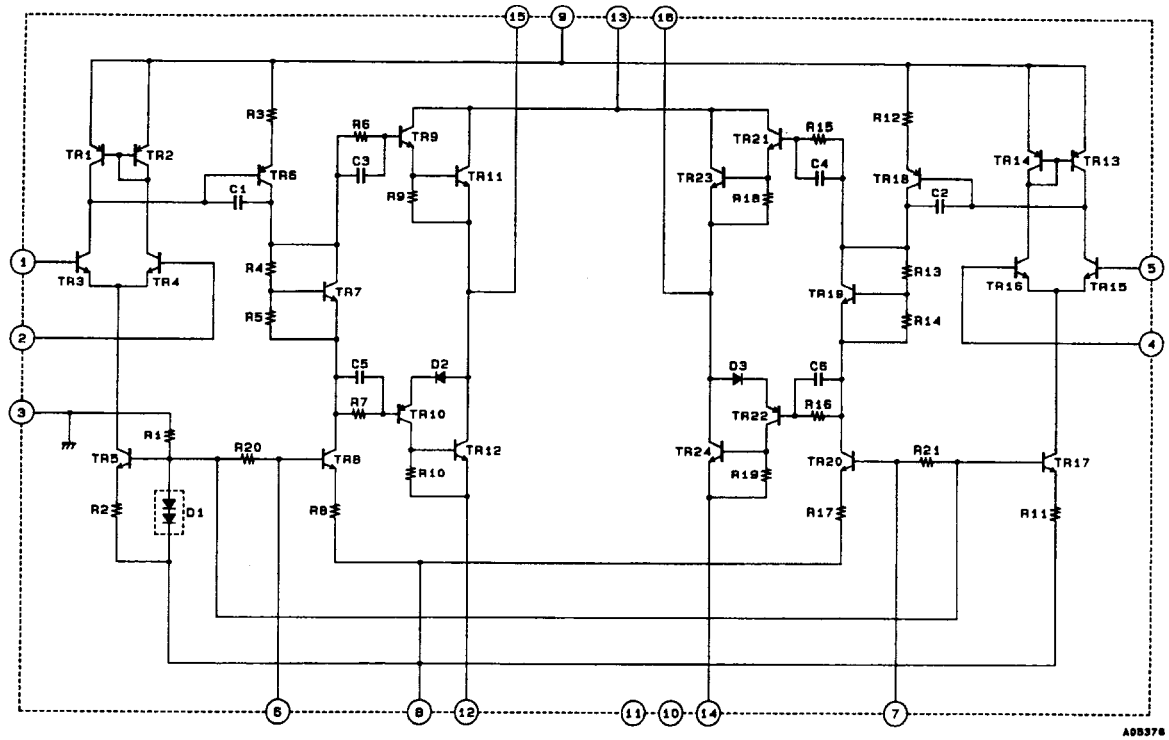
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output power	P_O1	V_{CC}=±32V, f=20Hz to 20kHz, THD=0.08%	50	55		W
	P_O2	V_{CC}=±26V, f=1kHz, THD=0.2%, R_L=3Ω	50	55		W
Total harmonic distortion	THD1	V_{CC}=±32V, f=20Hz to 20kHz, P_O=1.0W			0.08	%
	THD2	V_{CC}=±32V, f=1kHz, P_O=5.0W		0.007		%
Frequency response	f_L, f_H	V_{CC}=±32V, P_O=1.0W, $^{+0}_{-3}$ dB		20 to 50k		Hz
Input impedance	r_i	V_{CC}=±32V, f=1kHz, P_O=1.0W		55		kΩ
Output noise voltage	V_{NO}	V_{CC}=±39V, Rg=10kΩ			1.2	mVrms
Quiescent current	I_{CCO}	V_{CC}=±39V	20	60	100	mA
Neutral voltage	V_N	V_{CC}=±39V	–70	0	+70	mV

Note.
All tests are measured using a constant-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.

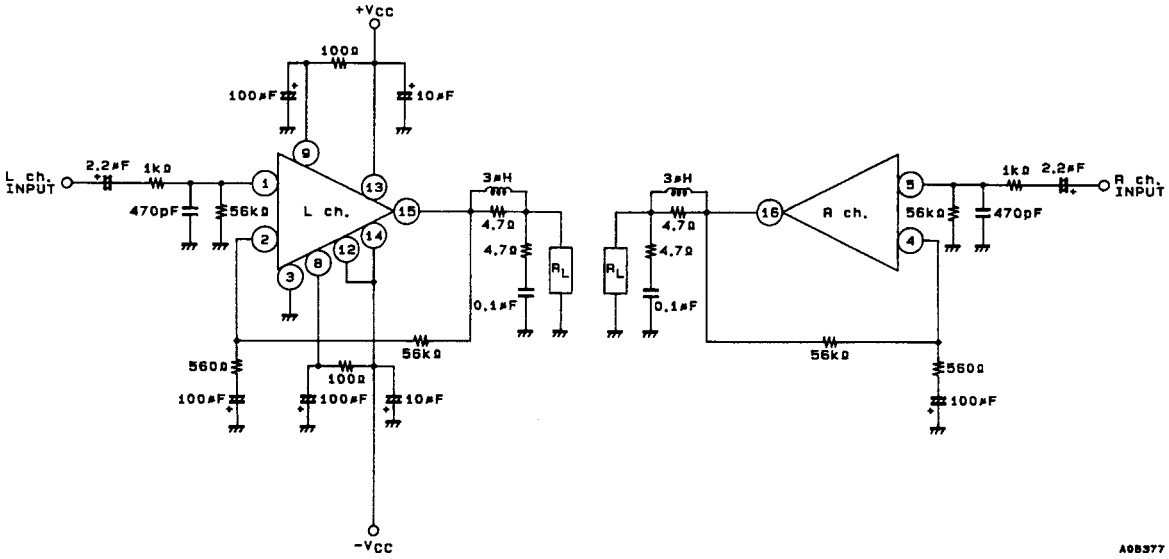
Specified Transformer Supply (MG-200 or Equivalent)



Equivalent Circuit



Sample Application Circuit



Series Configuration

These devices form a series of pin-compatible devices with different number of output channels, output ratings and total harmonic distortion. Some of these devices are under development. Contact your Sanyo sales representative if you require more detailed information.

STK400-000, STK400-200 series (3-channel, same output rating)					STK401-000, STK401-200 series (2-channel)					Supply voltage [V][1]			
Type No.	THD [%]	Type No.	THD [%]	Rated output	Type No.	THD [%]	Type No.	THD [%]	Rated output	V_{CC} max1	V_{CC} max2	V_{CC}1	V_{CC}2
STK400-010	0.4	STK400-210	0.08	10W×3	STK401-010	0.4	STK401-210	0.08	10W×2	-	±26.0	±17.5	±14.0
STK400-020		STK400-220		15W×3	STK401-020		STK401-220		15W×2	-	±29.0	±20.0	±16.0
STK400-030		STK400-230		20W×3	STK401-030		STK401-230		20W×2	-	±34.0	±23.0	±19.0
STK400-040		STK400-240		25W×3	STK401-040		STK401-240		25W×2	-	±36.0	±25.0	±21.0
STK400-050		STK400-250		30W×3	STK401-050		STK401-250		30W×2	-	±39.0	±26.0	±22.0
STK400-060		STK400-260		35W×3	STK401-060		STK401-260		35W×2	-	±41.0	±28.0	±23.0
STK400-070		STK400-270		40W×3	STK401-070		STK401-270		40W×2	-	±44.0	±30.0	±24.0
STK400-080		STK400-280		45W×3	STK401-080		STK401-280		45W×2	-	±45.0	±31.0	±25.0
STK400-090		STK400-290		50W×3	STK401-090		STK401-290		50W×2	-	±47.0	±32.0	±26.0
STK400-100		STK400-300		60W×3	STK401-100		STK401-300		60W×2	-	±51.0	±35.0	±27.0
STK400-110		STK400-310		70W×3	STK401-110		STK401-310		70W×2	±56.0	-	±38.0	-
					STK401-120		STK401-320		80W×2	±61.0	-	±42.0	-
					STK401-130		STK401-330		100W×2	±65.0	-	±45.0	-
					STK401-140		STK401-340		120W×2	±74.0	-	±51.0	-

STK400-400, STK400-600 series (3-channel, different output ratings)						Supply voltage [V][1]			
Type No.	THD [%]	Type No.	THD [%]	Rated output		V_{CC} max1	V_{CC} max2	V_{CC}1	V_{CC}2
STK400-450	0.4	STK400-650	0.08	Cch	30W	-	±39.0	±26.0	±22.0
				Lch, Rch	15W	-	±29.0	±20.0	±16.0
STK400-460		STK400-660		Cch	35W	-	±41.0	±28.0	±23.0
				Lch, Rch	15W	-	±29.0	±20.0	±16.0
STK400-470		STK400-670		Cch	40W	-	±44.0	±30.0	±24.0
				Lch, Rch	20W	-	±34.0	±23.0	±19.0
STK400-480		STK400-680		Cch	45W	-	±45.0	±31.0	±25.0
				Lch, Rch	20W	-	±34.0	±23.0	±19.0
STK400-490		STK400-690		Cch	50W	-	±47.0	±32.0	±26.0
				Lch, Rch	25W	-	±36.0	±25.0	±21.0
STK400-500		STK400-700		Cch	60W	-	±51.0	±35.0	±27.0
				Lch, Rch	30W	-	±39.0	±26.0	±22.0
STK400-510		STK400-710		Cch	70W	±56.0	-	±38.0	-
				Lch, Rch	35W	-	±41.0	±28.0	±23.0
STK400-520		STK400-720		Cch	80W	±61.0	-	±42.0	-
				Lch, Rch	40W	-	±44.0	±30.0	±24.0
STK400-530		STK400-730		Cch	100W	±65.0	-	±45.0	-
				Lch, Rch	50W	-	±47.0	±32.0	±26.0

1. V_{CC} max1 (R_L=6Ω), V_{CC} max2 (R_L=3 to 6Ω), V_{CC}1 (R_L=6Ω), V_{CC}2 (R_L=3Ω)

Heatsink Design Considerations

The heatsink thermal resistance, θc-a, required to dissipate the STK401-290 device total power dissipation, Pd, is determined as follows :

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

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

Where Ta is the guaranteed maximum ambient temperature.

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

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

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

$\theta c\text{-}a < (150 - Ta)/Pd - \theta j\text{-}c/N$ ..... (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 STK401-290 V_{CC}=±32V and R_L=6Ω, for a continuous sine wave signal, is a maximum of 71W, as shown in the Pd–P_O graphs.

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=44W [for (1/10) × P_O max=5W]

The STK401-290 has 4 power transistors, and the thermal resistance per transistor, θj-c, is 1.7°C/W. If the guaranteed maximum ambient temperature, Ta, is 50°C, then the required heatsink thermal resistance, θc-a, is :

From expression (1)' : $\theta c\text{-}a < (125-50)/44$
< 1.70

From expression (2)' : $\theta c\text{-}a < (150-50)/44 - 1.7/4$
< 1.84

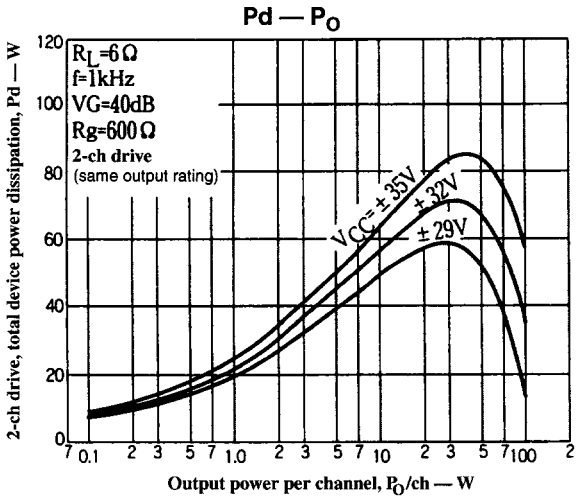
Therefore, to satisfy both expressions, the required heatsink must have a thermal resistance less than 1.70°C/W.
Similarly, when STK401-290 V_{CC}=±26V and R_L=3Ω,

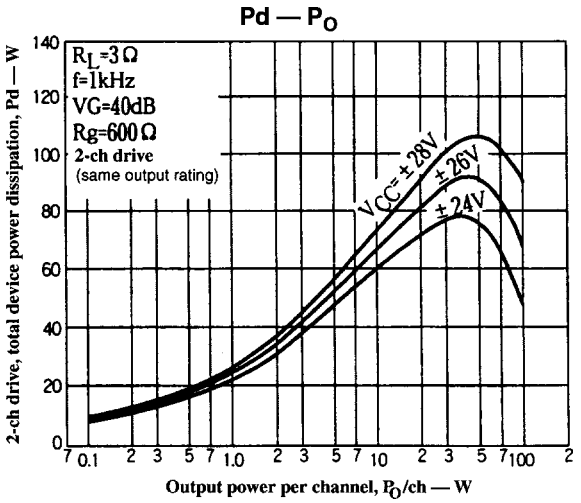
Pd=51.2W [for (1/10) × P_O max=5W]

From expression (1)' : $\theta c\text{-}a < (125-50)/51.2$
< 1.46

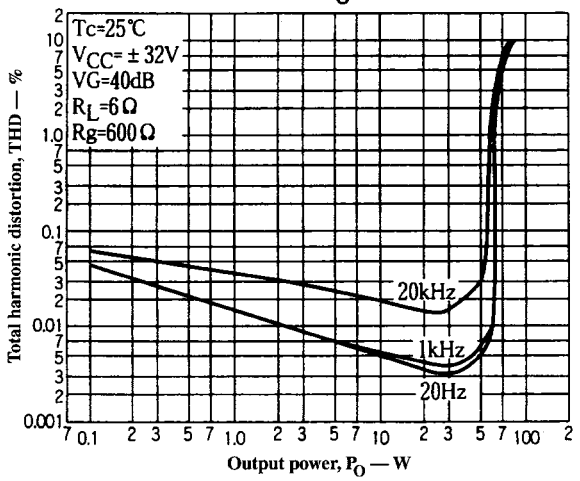
From expression (2)' : $\theta c\text{-}a < (150-50)/51.2 - 1.7/4$
< 1.52

Therefore, to satisfy both expressions, the required heatsink must have a thermal resistance less than 1.46°C/W.
This heatsink design example is based on a constant-voltage supply, and should be verified within your specific set environment.

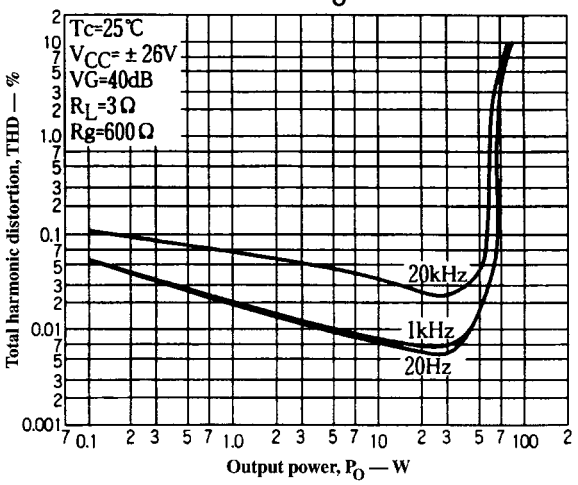




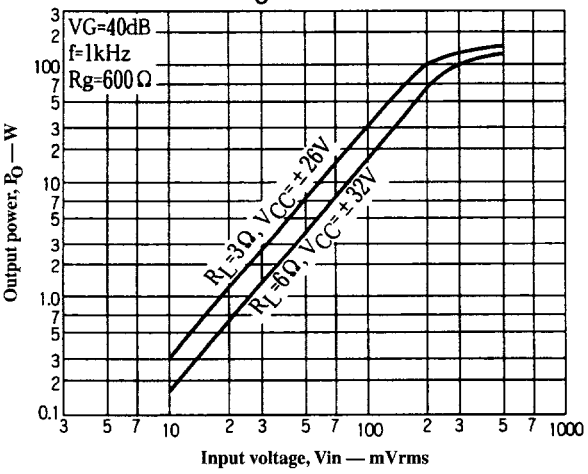
THD — P_O



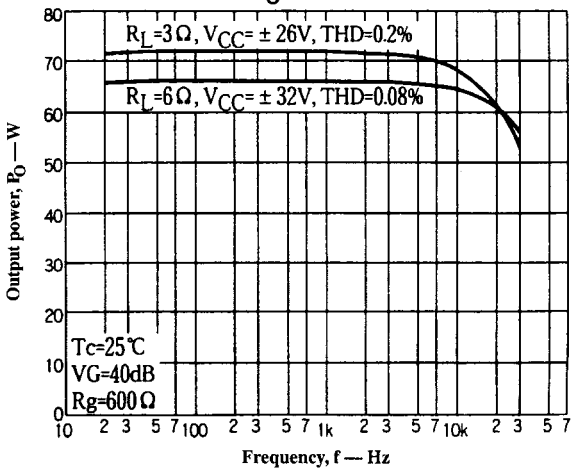
THD — P_O



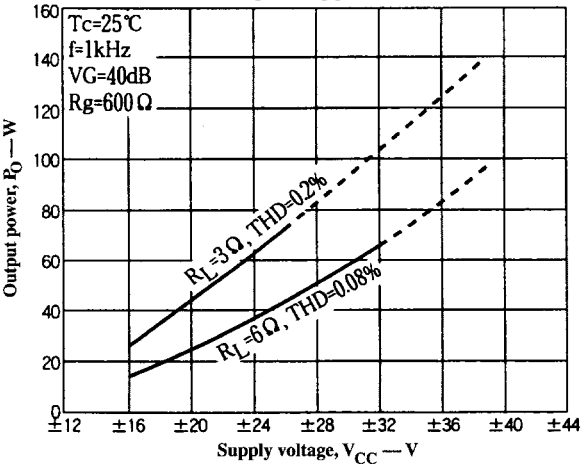
P_O — Vin



P_O — f



P_O — V_{CC}



VG — f