

STK4192II

AF Power Amplifier (Split Power Supply) (50W + 50W min, THD = 0.4%)

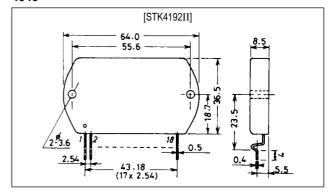
Features

- The STK4102II series (STK4192II) and STK4101V series (high-grade type) are pin-compatible in the output range of 6W to 50W and enable easy design.
- Small-sized package whose pin assignment is the same as that of the STK4101II series
- Built-in muting circuit to cut off various kinds of popnoise
- Greatly reduced heat sink due to substrate temperature 125°C guaranteed
- Excellent cost performance

Package Dimensions

unit: mm

4040



Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V _{CC} max		±52.5	V
Thermal resistance	<i>θ</i> j-c		1.8	°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	$V_{CC} = \pm 35V$, $R_L = 8\Omega$, $f = 50Hz$, $P_O = 50W$	2	s

Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V _{CC}		±35	V
Load resistance	R_L		8	Ω

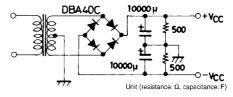
Operating Characteristics	at Ta = 25°C, V_{CC} = ±35V, R_L = 8 Ω , Rg = 600 Ω , VG = 40dB,
	R _L : non-inductive load

Parameter	Symbol	Conditions	min	typ	max	Unit
Quiescent current	Icco	V _{CC} = ±42V	20	40	100	mA
Output power	P _O (1)	THD = 0.4%, f = 20Hz to 20kHz	50			W
	P _O (2)	$V_{CC} = \pm 31V$, THD = 1.0%, $R_L = 4\Omega$, $f = 1kHz$	55			W
Total harmonic distortion	THD	P _O = 1.0W, f = 1kHz			0.3	%
Frequency response	f _L , f _H	$P_0 = 1.0W, {}^{+0}_{-3} dB$		20 to 50k		Hz
Input impedance	r _i	P _O = 1.0W, f = 1kHz		55		kΩ
Output noise voltage	V _{NO}	$V_{CC} = \pm 42V$, $Rg = 10k\Omega$			1.2	mVrms
Neutral voltage	V_N	V _{CC} = ±42V	-70	0	+70	mV
Muting voltage	V_{M}		-2	-5	-10	V

Notes.

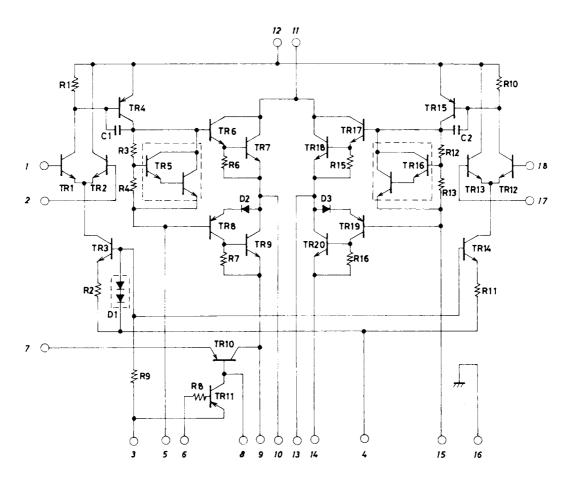
For power supply at the time of test, use a constant-voltage power supply unless otherwise specified.

For measurement of the available time for load short-circuit and output noise voltage, use the specified transformer power supply shown right. The output noise voltage is represented by the peak value on rms scale (VTVM) of average value indicating type. For AC power supply, use an AC stabilized power supply (50Hz) to eliminate the effect of flicker noise in AC primary line.

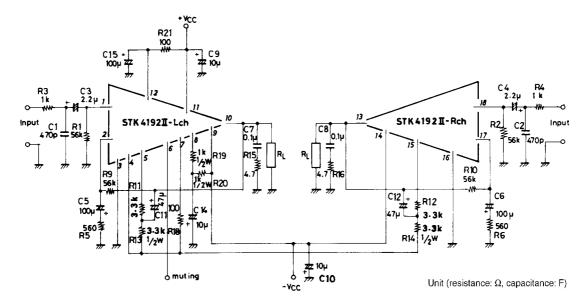


Specified Transformer Power Supply (Equivalent to MG-200)

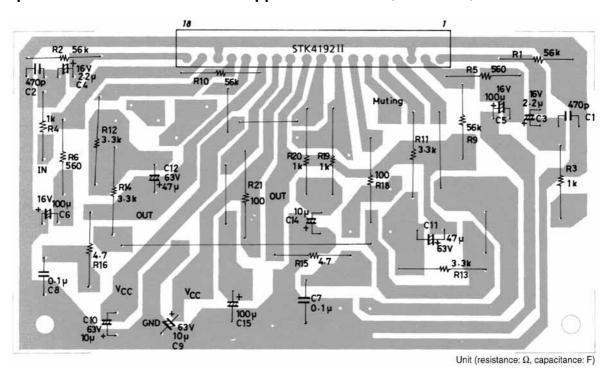
Equivalent Circuit

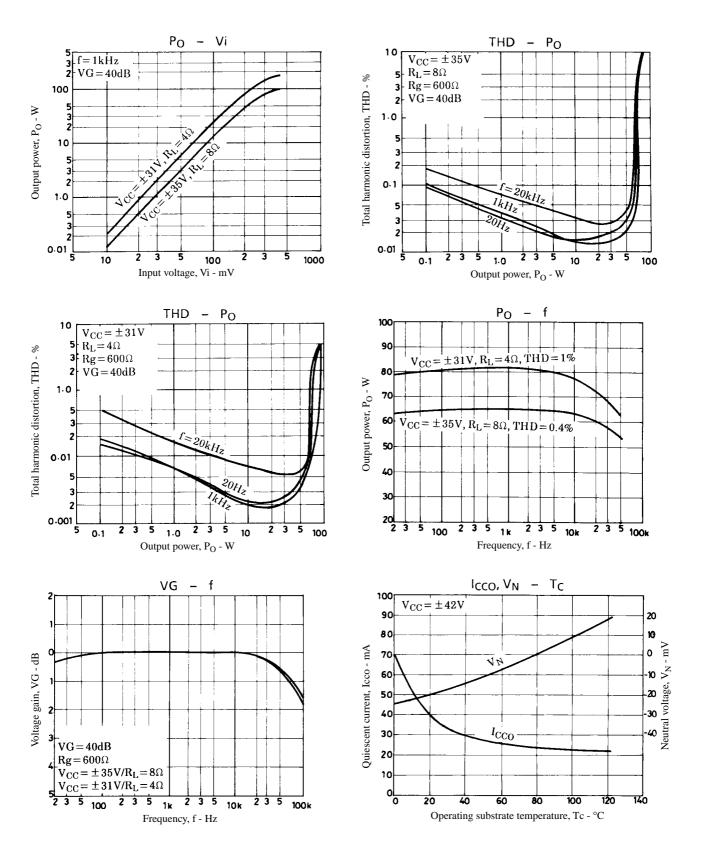


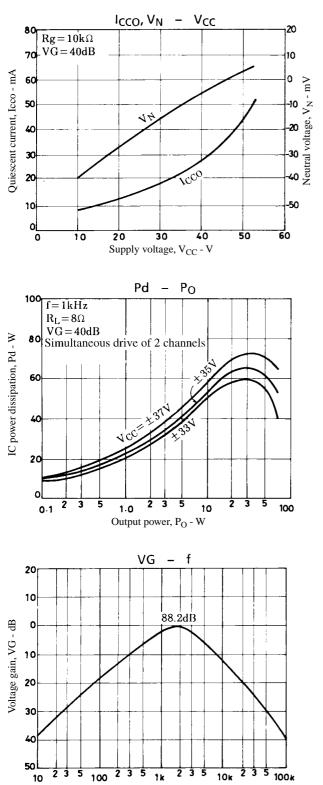
Sample Application Circuit: 50W min 2-channel AF power amplifier

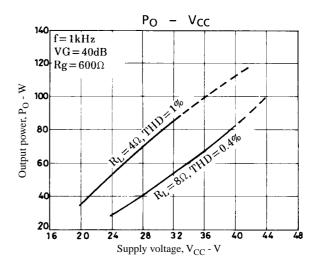


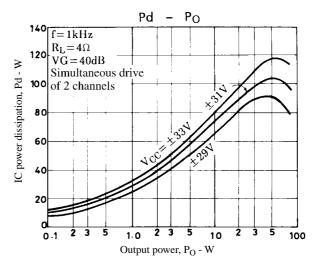
Sample Printed Circuit Pattern for Application Circuit (Cu-foiled side)



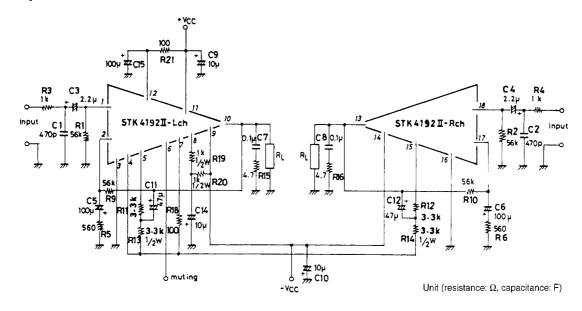






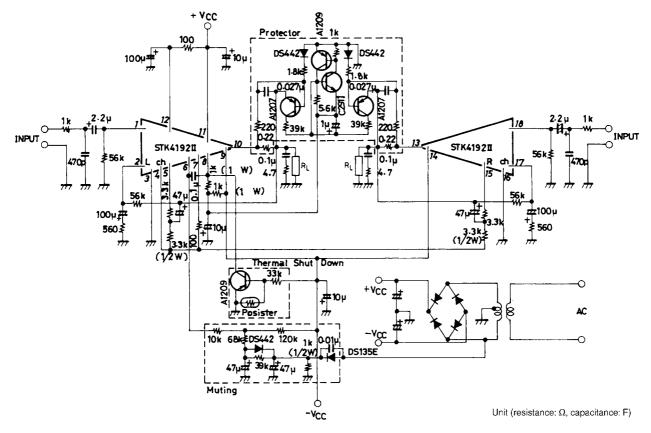


Description of External Parts



Input coupling capacitors		
 Used to block DC current. When the reactance of the capacitor increases at low frequencies, the dependence of 1/f noise on signal source resistance causes the output noise to worsen. It is better to decrease the reactance. To reduce the pop noise at the time of application of power, it is effective to increase C3, C4 that fix the time constant on the input side and to decrease C5, C6 on the NF side. NF capacitors • These capacitors fix the low cutoff frequency as shown below. f L = 1/2π·C5·R5 [Hz] To provide the desired voltage gain at low frequencies, it is better to increase C5. However, do not increase C5 more than needed because the pop noise level becomes higher at the time of application of power. C15 Decoupling capacitor • Used to eliminate the ripple components that mix into the input side from the power line (+V_{CC}). C11, C12 Bootstrap capacitors • When the capacitor ratule is decreased, the distortion is liable to be higher at low frequencies. C9, C10 C9, C10 C3, C3, C4 C4 C3, C5, C6 C4 C4 C4 C5, C6 C5, C6 C6 C7 C9, C10 C9, C10 C9, C10 C14 C9, C10 C15 C9, C10 C9, C10 C16 C17 C18 C18 C9, C10 C9, C10 C19 C9, C10 C9, C10 C10 C10 C10 C11 C11 C12 C12 C14 C9, C10 C9, C10 C9, C10 C9, C10 C14 C9, C10 C15 C9, C10 C14 C9, C10 C17 C18 C9, C10 C9, C10 C9, C10 C18 C19 C9, C10 C19 C9, C10 C9, C10 C9, C10 C9, C10<td>C1, C2</td><td> ' · · ·</td>	C1, C2	' · · ·
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C14 • Capacitor for the TR10-used ripple filter in the IC system C7 Oscillation blocking capacitor • A polyester film capacitor, being excellent in temperature characteristic, frequency characteristic, is recommended for C7. R3, R4 Resistors for input filter R1, R2 Input bias resistors • Used to bias the input pin potential to zero. These resistors fix the input impedance practically. R5, R9 (R6, R10) R5, R9 (R6, R10) These resistors fix voltage gain VG. It is recommended to use R5 (R6) = 560Ω, R9 (R10) = 56kΩ for VG = 40dB. • To adjust VG, it is desirable to change R9 (or R10). • When R9 (or R10) is changed to adjust VG, R1 (=R2) =R9 (=R10) must be set to ensure V _N balance. R11, R13 (R12, R14) Bootstrap resistors • The quiescent current is set by these resistors 3.3kΩ + 3.3kΩ. It is recommended to use this resistor value. R21 Resistor for ripple filter • Limiting resistor for predriver transistor at the time of load short R18 Used to ensure plus/minus balance at the time of clip. Resistor for ripple filter • When muting TR11 is turned ON, current flows from ground to -V _{CC} through TR 11. It is recommended to use 1kΩ (1W) + 1kΩ (1W) allowing for the power that may be dissipated on that occasion.	C9, C10	• Must be inserted as close to the IC power supply pins as possible so that the power supply impedance is decreased to operate the IC stably.
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R15, R16 Oscillation blocking resistors	R19, R20	• When muting TR11 is turned ON, current flows from ground to -V _{CC} through TR 11. It is recommended to use $1k\Omega$ (1W) + $1k\Omega$ (1W)
	R15, R16	Oscillation blocking resistors

Sample Application Circuit (protection circuit and muting circuit)



Thermal Design

The IC power dissipation of the STK4192II at the IC-operated mode is 66W max. at load resistance 8Ω and 103W max. at load resistance 4Ω (simultaneous drive of 2 channels) for continuous sine wave as shown in Figure 1 and 2.

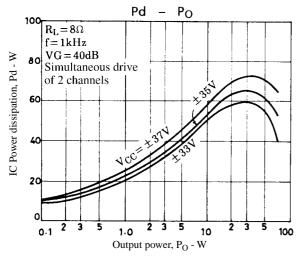


Figure 1. STK4192II Pd – P_O ($R_L = 8\Omega$)

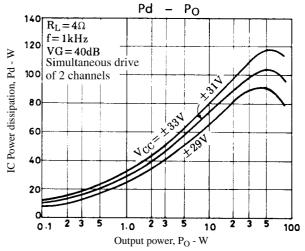


Figure 2. STK4192II Pd – P_O ($R_L = 4\Omega$)

In an actual application where a music signal is used, it is impractical to estimate the power dissipation based on the continuous signal as shown above, because too large a heat sink must be used. It is reasonable to estimate the power dissipation as 1/10 Po max. (EIAJ).

That is, Pd = 43W at 8Ω , Pd = 55W at 4Ω

Thermal resistance θ c-a of a heat sink for this IC power dissipation (Pd) is fixed under conditions 1 and 2 shown below.

Condition 1:
$$Tc = Pd \times \theta c - a + Ta \le 125^{\circ}C$$
....(1)

where Ta: Specified ambient temperature

Tc : Operating substrate temperature

Condition 2: Tj= Pd ×
$$(\theta c-a)$$
 + Pd/4 × $(\theta j-c)$ + Ta ≤ 150°C....(2)

where T_j: Junction temperature of power transistor

Assuming that the power dissipation is shared equally among the four power transistors (2 channels \times 2), thermal resistance θ j-c is 1.8°C/W and

$$Pd \times (\theta c - a + 1.8/4) + Ta \le 150^{\circ}C$$
....(3)

Thermal resistance θ c-a of a heat sink must satisfy inequalities (1) and (3).

Figure 3 shows the relation between Pd and θ c-a given from (1) and (3) with Ta as a parameter.

[Example] The thermal resistance of a heat sink is obtained when the ambient temperature specified for a stereo amplifier is 50° C.

fied for a stereo amplifier is 50°C. Assuming $V_{CC} = \pm 35V$, $R_L = 8\Omega$, $V_{CC} = \pm 31V$, $R_L = 4\Omega$, $R_L = 8\Omega$: Pd1 = 43W at 1/10 Po max.

 $R_L = 4\Omega : Pd2 = 55W \text{ at } 1/10 \text{ Po max.}$

The thermal resistance of a heat sink is obtained from Figure 3.

 $R_L = 8\Omega : \theta c-a1 = 1.75^{\circ}C/W$

 $R_L = 4\Omega : \theta c - a2 = 1.35$ °C/W

Tj when a heat sink is used is obtained from (3).

 $R_L = 8\Omega : Tj = 144.6$ °C $R_L = 4\Omega : Tj = 149$ °C

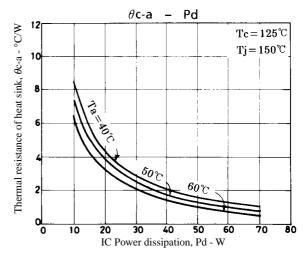


Figure 3. STK4192II θ c-a – Pd

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