PWM amplifier (HSA06)

1. Features (for outside view, see Fig. 1)

It can be used interchangeably with SA06 of APEX company.

10A continuous output current (Case temperature ≤75℃)

Thermal protection and programmable external current-limiting protection

Analog and digital input

Synchronous or external oscilloscope

Flexible frequency control

Size: 58.65×41.4×7.2mm³; weight: 55g

Fig. 1 Outside view of HSA06

2. Scope of application

Motor control;

Drive reactive load;

Drive low-frequency sonar;

Drive piezoelectric converter;

Offline drive;

C-D welding control.

3. Description

HSA06 is a kind of PWM operation amplifier, which can provide 5kW transmission power for load. There is a 45kHz oscillator inside, the clock input stage halves the oscillator frequency so as to provide the basic 22.5kHz switching frequency. External oscillator can be used to reduce switching frequency or used as synchronous signal of multiple power amplifiers. Shutting off the input end can turn off the four drive tubes of H bridge circuit; has the functions of current limiting and overheat protection.

The series of product adopts thick film hybrid integrated process, sealed in metal case. Design and manufacturing of products shall meet the requirements of GJB2438A-2002 "General specification of hybrid integrated circuit" and detailed specifications for products.

4. Electrical performance (Table 1, Table2)

Table 1 Rated conditions and recommended conditions

Absolute max. rated value	Supply voltage $+V_s$	+500V
	Supply voltage $+V_{cc}$	16V
	Input voltage, +PWM	0～+11V
	Input voltage, -PWM	0～+11V
	Input voltage, $I_{Lim/SHD}$	0～+10V
	Internal power loss	300W
	Storage temperature	−65～+150℃
	Operating tempreature(T_A)	−55～+125℃
Recommended operating conditions	Supply voltage $+V_s$	≤240V
	Supply voltage $+V_{cc}$	15V
	Input voltage, +PWM	3～7V
	Input voltage, I_{Lim}	0. 1V
	Storage temperature	−65～+150℃
	Operating temperature(T_A)	−55～ +125℃

5. Operating principle (Fig. 2)

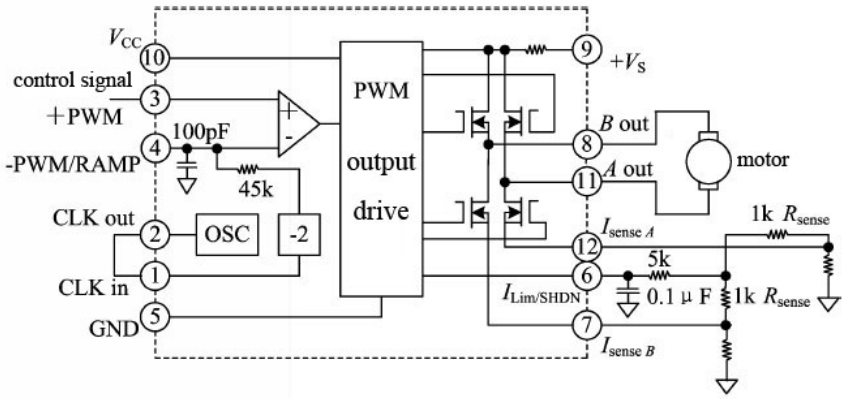

Fig. 2 Circuit block diagram

Table 2 Electric characteristics

Parameter	Test condition (−45～+85℃)	HSA06			Unit
		Min.	Typical	Max.	
Clock output low level	—	0	—	0.4	V
Oscillatory frequency	—	44.1	45	46.9	kHz
Central voltage of triangle wave	—	—	5	—	V
Peak-peak voltage of triangle wave	—	—	4	—	V
Clock input high level	—	3.7	—	5.4	V
Clock input low level	—	0	—	0.9	V
Operating frequency of switch	—	22.05	22.5	22.95	kHz
Output frequency	V_S=500V, output current is 10A	—	97	—	%
Continuous operating current	75℃ case temperature	—	10	—	A
Peak operating current	—	—	15	—	A
Power supply + V_s	—	16	240	500	V
Power supply + V_{cc}	—	14	15	16	V
+V_s static current	without load connected	—	—	90	mA
+V_{cc} static current	I_{out}=0	—	—	80	mA
+V_{cc} static current	shutdown	—	—	50	mA
I_{Lim}/ shutdown threshold	—	90	—	110	mV
Thermal resistance, junction to air	—	12	—	—	℃/W

6 MTBF curve(Fig. 3)

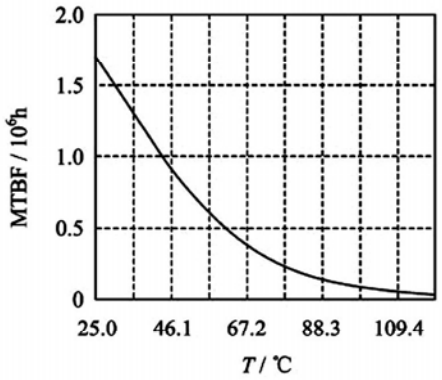

Fig. 3 MTBF-temperature curve

(Note: as per GJB/Z299B-98, envisaged good ground condition)

7 Pin designation (Fig. 4, Table 3)

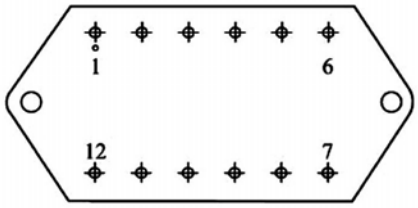

Fig. 4 Schematic diagram of pins(bottom view)

Table 3 Pin designation

Pin	Symbol	Function	Pin	Symbol	Function
1	CLK in	Clock input	7	$I_{sense\ B}$	Current sensing output B
2	CLK out	Clock output	8	B out	Output B
3	+PWM	Control signal input	9	$+V_S$	Power $+V_S$ input
4	−PWM/RAMP	Internal triangle wave output	10	$+V_{CC}$	Power $+V_{CC}$ input
5	GND	System ground	11	A out	Output A
6	$I_{Lim/SHDN}$	Current-limiting shutdown input	12	$I_{sense\ A}$	Current sensing output A

8. Connection diagram for typical application

HSA06 has two current sampling terminals I_{senseA} and I_{senseB}, when adopting voltage mode control, these two terminals shall be short-circuited, the typical connection diagram is shown as in Fig. 5; while adopting current control, they shall be connected to sampling resistance and the sampling resistance shall choose non-inductive resistance, the typical connection diagram is shown as in Fig. 2.

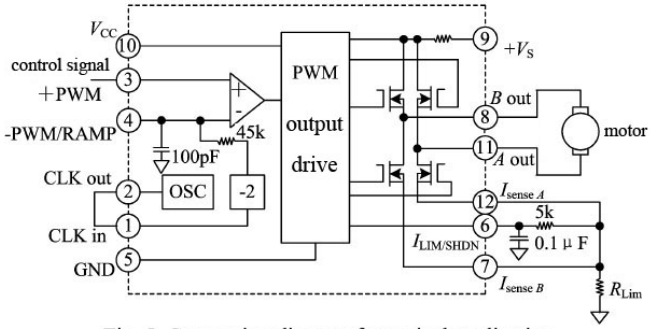

Fig. 5 Connection diagram for typical application

(1) Bypass of power supply

HSA06 power supply shall have adequate bypass to ensure it runs properly, otherwise, it may be unstable and its efficiency may be reduced and output may oscillate. V_s power supply shall be added with at least 1μF ceramic capacitance, then connected with a bypass capacitance of a low ESR value in parallel, its magnitude shall select 10μF/A at least; for V_{cc} power supply, it shall also be connected with a 0.1~0.47μF ceramic capacitance in parallel and a 6.8~10μF bypass capacitance of a low ESR value.

(2) Overcurrent protection technology

See Fig. 6 for typical connection under the mode of voltage.

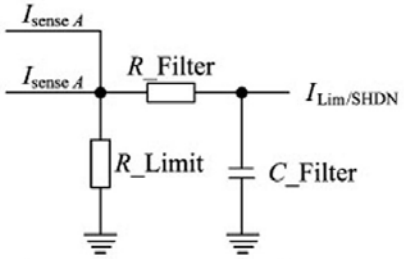

Fig. 6 Typical connection diagram of external current-limiting resistance

Current-limiting control circuit is designed in order to guarantee amplifier operating in safe operation area S0A. Current-limiting value shall not exceed the maximum rated current of the amplifier, otherwise, the amplifier will be damaged.

Because the output current will flow through the current-limiting resistance, its rated power shall be considered, from the point of view of reliability, the resistance value shall be selected as big as possible, and the calculation formulas of current-limiting resistance and its power consumption are as follows:

$$R_{Lim} = \frac{0.1}{I_{Lim}} \text{ ; } P_{R_{Lim}} = 0.1 \times I_{Lim},$$

I_{Lim} is the set current-limiting value, at the beginning, set R-Filter and C-Filter to 5kΩ and 0.01μF, respectively.

9. Package specification (unit: mm)(Fig. 7, Table 4)

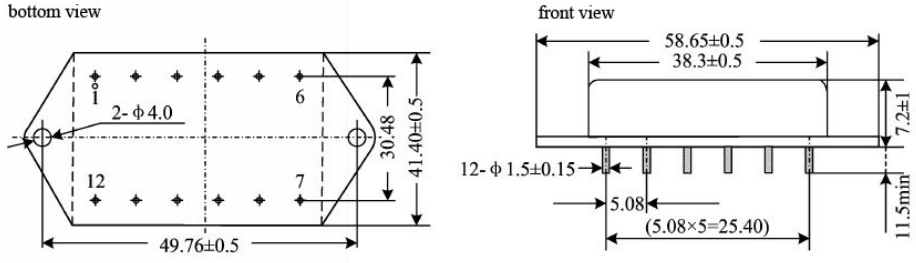

Fig. 7 Outside view and dimensions of package

Table 4 Case materials

Case model	Header	Header plating	Cover	Covering plating	Pin material	Pin plating	Sealing style	Notes
UPP4138 -12a	Cold rolled steel (10#)	Ni	Iron/ nickel alloy (4J42)	Ni	Copper compound	Ni	Compression seal	

Note: temperature of the welded pin shall not exceed 300℃ within 10s.

10. Part numbering key (Fig. 8)

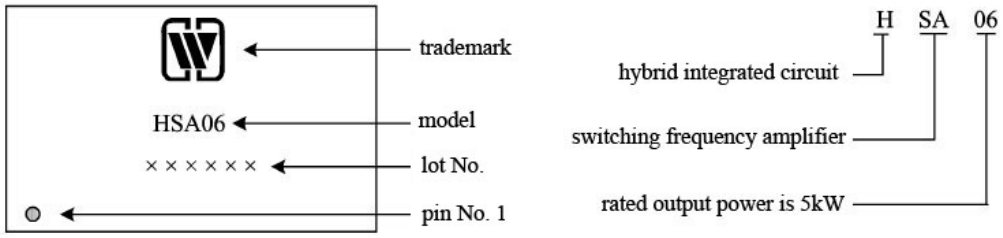

Fig. 8 Part numbering key

Application notes

Switch on power supply correctly, during the power-up, accurately connect the positive and negative poles of power to avoid burnout.

When carrying out the electrical performance test, the test position shall be the pinouts of the product.

Upon assembly, the bottom of the product shall fit to the circuit board closely so as to avoid damage of pins, and shockproof provision shall be added, if necessary.

Do not bend the pinouts to prevent the insulator from breaking, which affects the sealing property.

The circuit shall be added with heat sinking device, and the size of radiator depends upon the output power.

When the user places an order for the product, detailed electric performance indexes shall refer to the relevant enterprise standard.