

System power supply for CD player-equipped audio systems

BA3963

With 5V and 7V outputs and a reset output that detects the 5V output, the BA3963 power supply IC is best suited for CD player-equipped audio systems.

● Applications

CD player-equipped audio systems

● Features

- 1) A 5V output, a 7V output, and a reset output are built in.
- 2) All output circuits use a PNP transistor with a low saturation voltage.
- 3) Current limit circuit protects the IC against short-circuiting damage.
- 4) Thermal protection circuit prevents heat damage to the IC.
- 5) Compact SIP-M12 package allows a large power dissipation.

● Absolute maximum ratings (Ta = 25°C)

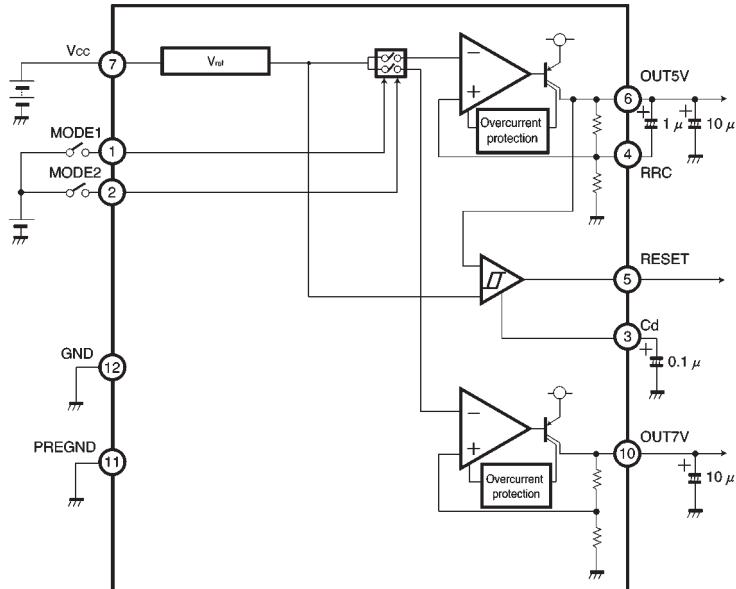
Parameter	Symbol	Limits	Unit
Power supply voltage	Vcc	23	V
Power dissipation	Pd	3000*	mW
Operating temperature	Topr	-25~+75	°C
Storage temperature	Tstg	-55 ~+150	°C

* Reduced by 24mW for each increase in Ta of 1°C over 25 °C.

● Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	Vcc	5.6	12	22	V

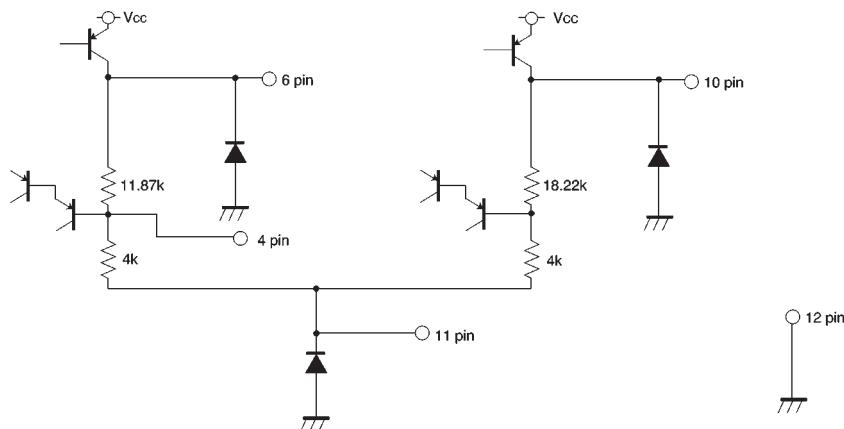
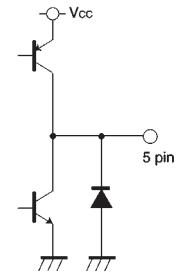
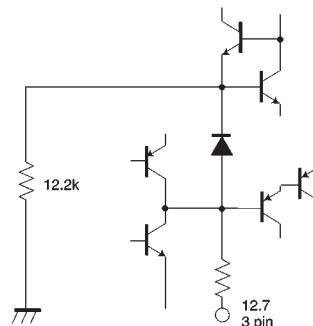
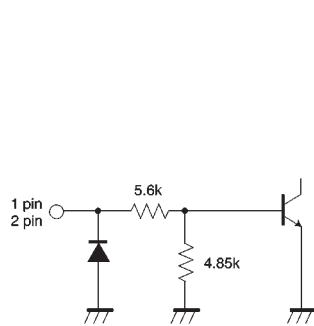
● Block diagram



● Pin descriptions

Pin No.	Pin name	Function
1	MODE1	5V output ON/OFF switching
2	MODE2	7V output ON/OFF switching
3	C	Capacitor pin for setting the delay time
4	RRC	Capacitor pin for improving the ripple rejection
5	Reset output	Power supply output current (1mA)
6	5V output	Power supply output current (400mA)
7	Vcc	DC power supply input
8	N. C.	—
9	N. C.	—
10	7V output	Power supply output current (1A)
11	PRE GND	Small current GND
12	GND	Large current GND

● Input / output circuits



Units: R [Ω]

●Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$ and $V_{cc} = 12\text{V}$)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Standby supply current	I_{ST}	—	720	900	μA	$V_{TH1}, V_{TH2}=0\text{V}$
⟨5 V output section⟩						
Output voltage 1	V_{O1}	4.75	5.0	5.25	V	$I_{O1}=320\text{mA}$
Voltage regulation	ΔV_{O11}	—	70	200	mV	$I_{O1}=320\text{mA}$
Load regulation	ΔV_{O12}	—	65	200	mV	$I_{O1}=0\sim320\text{mA}$
Minimum I/O voltage differential	ΔV_{O13}	—	0.7	1.0	V	$I_{O1}=320\text{mA}$
Output current capacity	I_{O1}	400	—	—	mA	
Ripple rejection ratio	R.R11	50	64	—	dB	$f=120\text{Hz}, I_{O1}=320\text{mA}$
Ripple rejection ratio *	R.R12	60	74	—	dB	$f=120\text{Hz}, I_{O1}=320\text{mA}$
⟨7 V output section⟩						
Output voltage 2	V_{O2}	6.65	7.0	7.35	V	$I_{O2}=800\text{mA}$
Voltage regulation	ΔV_{O21}	—	65	200	mV	$I_{O2}=800\text{mA}$
Load regulation	ΔV_{O22}	—	140	300	mV	$I_{O2}=0\sim800\text{mA}$
Minimum I/O voltage differential	ΔV_{O23}	—	0.7	1.0	V	$I_{O2}=800\text{mA}$
Output current capacity	I_{O2}	1.0	—	—	A	
Ripple rejection ratio	R.R2	50	57	—	dB	$f=120\text{Hz}, I_{O2}=800\text{mA}$
⟨Reset section⟩						
Output voltage when HIGH	V_{res1}	4.7	4.95	5.2	V	$I_{load}=1\text{mA}$
Output voltage when LOW	V_{res2}	—	0.1	0.2	V	$I_{sink}=0.5\text{mA}$
Threshold voltage	V_{reth}	3.95	4.2	4.45	V	
Hysteresis voltage	V_{hys}	50	150	250	mV	
Reset output delay time	T_d	7.5	10	12.5	ms	$C_d=0.1\text{ }\mu\text{F}$
⟨Output control section⟩						
MODE 1 threshold voltage	V_{TH1}	1.1	1.4	1.7	V	
MODE 2 threshold voltage	V_{TH2}	1.1	1.4	1.7	V	
Input high level current	I_m	0.46	0.77	1.1	mA	$V_{TH1}, V_{TH2}=5\text{V}$

* Asterisked ripple rejection ratio corresponds to the case where capacitors ($1\text{ }\mu\text{F}$) are used between pins 4 and 6.

©Not designed for radiation resistance.

●Circuit operation

OUT 5V rises when MODE 1 is 1.4V (Typ.), and OUT 7V rises when MODE 2 is 1.4V (Typ.). The reset output rises with a delay time (t_d) when OUT 5V is 4.2V (Typ.), and rises when OUT 5V is 4.1V (Typ.).

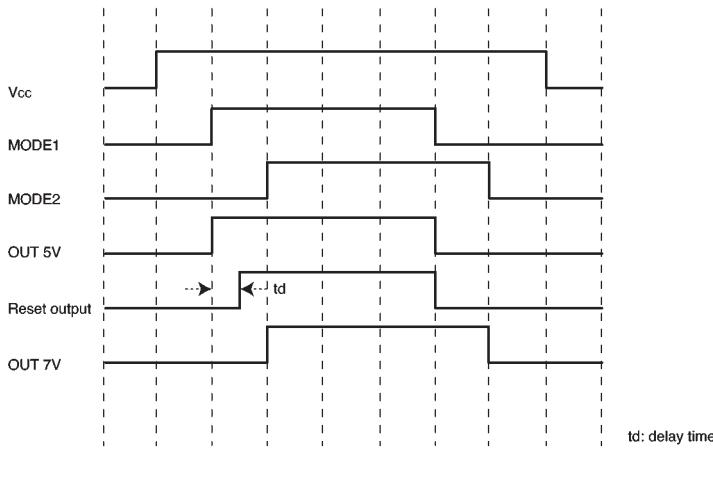


Fig.1 Timing chart

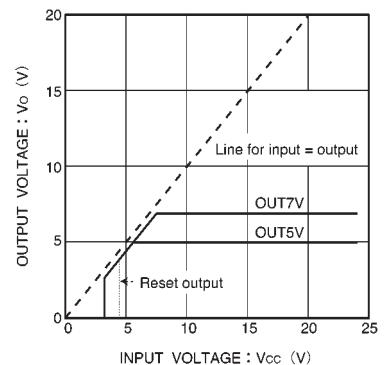


Fig.2 Input voltage vs. output voltage

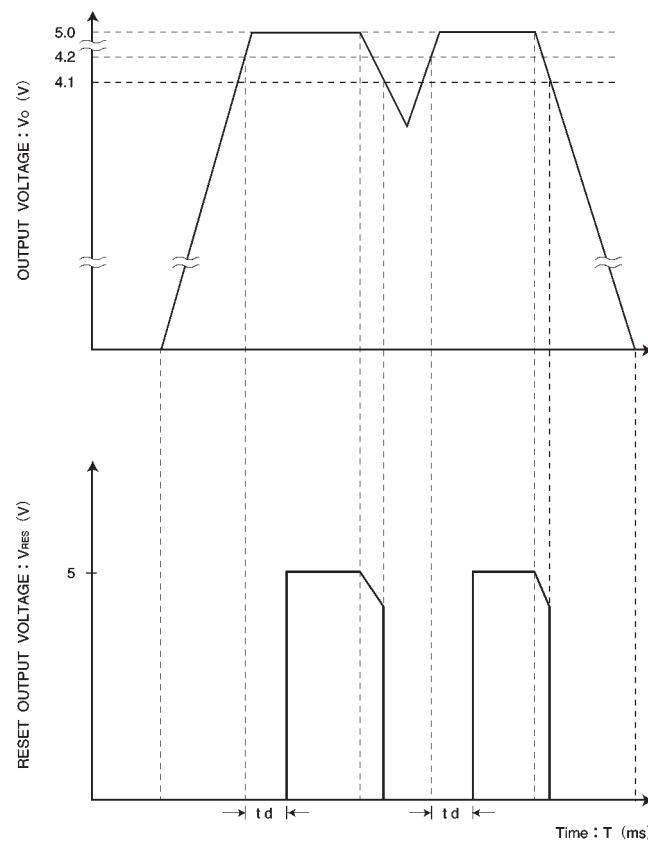


Fig.3 Timing of reset operation

● Application example

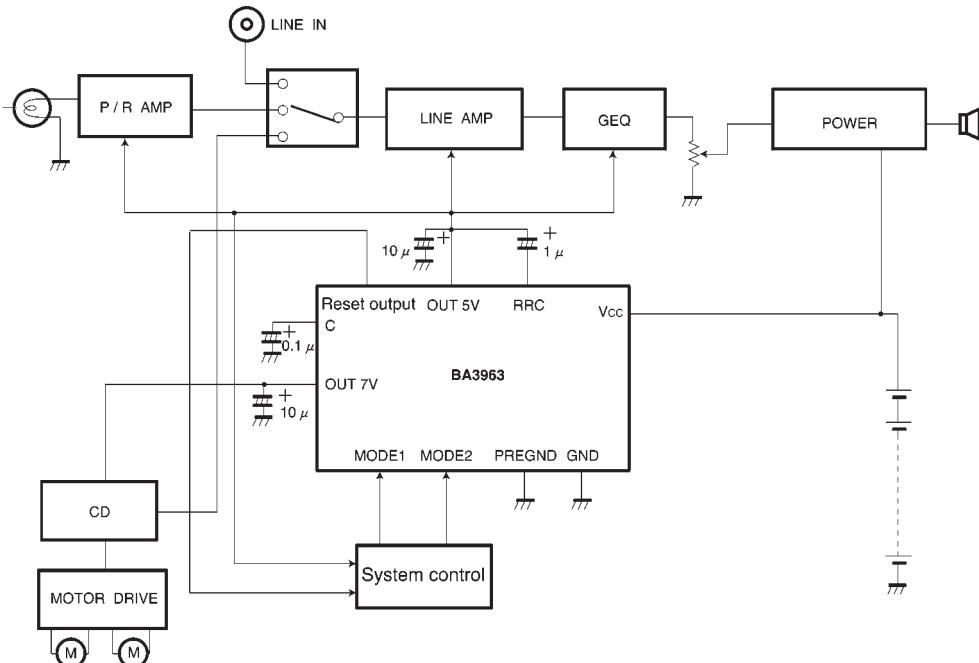


Fig.4

● Operation notes

(1) Operating power supply voltage

When operating within proper ranges of power supply voltage and ambient temperature, most circuit functions are guaranteed. Although the rated values of electrical characteristics cannot be absolutely guaranteed, characteristic values do not change drastically within the proper ranges.

(2) Power dissipation (Pd)

Refer to the heat reduction curves (Fig. 5) and the rough estimation of IC power dissipation given on a separate page. If power dissipation exceeds the allowable limit, the functionality of IC will be degraded (such as reduction of current capacity by increased chip temperature). Make sure to use the IC within the allowable range of power dissipation with a sufficient margin.

(3) Preventing oscillation at each output

To stop oscillation of output, make sure to connect a capacitor having a capacitance of $10\mu\text{F}$ or greater between GND and each output pin. Also, the 5V output ripple rejection is improved by connecting a capacitor having a capacitance of $1\mu\text{F}$ or greater between pins 4 and 6. When connecting the capacitors, be sure to connect the polarities correctly. Oscillation of output can occur if capacitance is susceptible to temperature. We recommend using a tantalum electrolytic capacitor with minimal changes in capacitance.

(4) Overcurrent protection circuit

An overcurrent protection circuit is installed in each output system, based on the respective output current. This prevents IC destruction by overcurrent, by limiting the current with a curve shape of "7" in the voltage-current graph. The IC is designed with margins so that current flow will be restricted and latching will be prevented even if a large current suddenly flows through a large capacitor. Note that these protection circuits are only good for preventing damage from sudden accidents. Make sure your design does not cause the protection circuit to operate continuously under transitional conditions (for instance, when output is clamped at $1V_F$ or higher, short mode circuit operates at $1V_F$ or lower). Note that the circuit ability is negatively correlated with temperature.

● Thermal derating curve

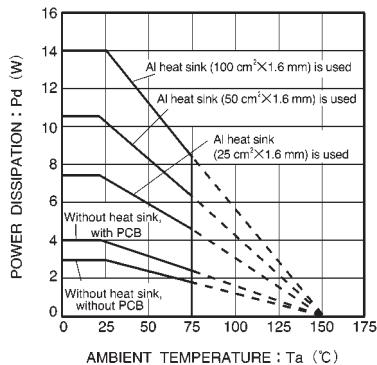


Fig.5

Estimate of allowable power dissipation ($P_{MAX.}$)

- Power consumed by OUT 5V
- Power consumed by OUT 7V
- Power consumed by the reset output
- Power consumed internally by each circuit

$$\begin{aligned}
 P_1 &= (V_{cc} - 5V) \times \text{maximum output current of OUT 5V} \\
 P_2 &= (V_{cc} - 7V) \times \text{maximum output current of OUT 7V} \\
 P_3 &= (V_{cc} - 4.95V) \times \text{maximum output current of the reset output} \\
 P_4 &= V_{cc} \times \text{supply current}
 \end{aligned}$$

$$P_{MAX.} = P_1 + P_2 + P_3 + P_4$$

● External dimensions (Units: mm)

