

Fluorescent display tube level meter driver, 16-point × 2 channel, VU scale, bar display

BA6803S

The BA6803S is a two-channel, 16-point fluorescent display tube driver for VU-scale bar-level meters. It uses a dynamic-drive system and has both AC and DC inputs.

The AC input mode has a peak hold circuit. The IC features a power-on mute, and the output block can directly drive fluorescent display tubes, so few external components are required.

The grid output duty cycle is 1 / 8.

● Applications

Level meters for all types of AV equipment

● Features

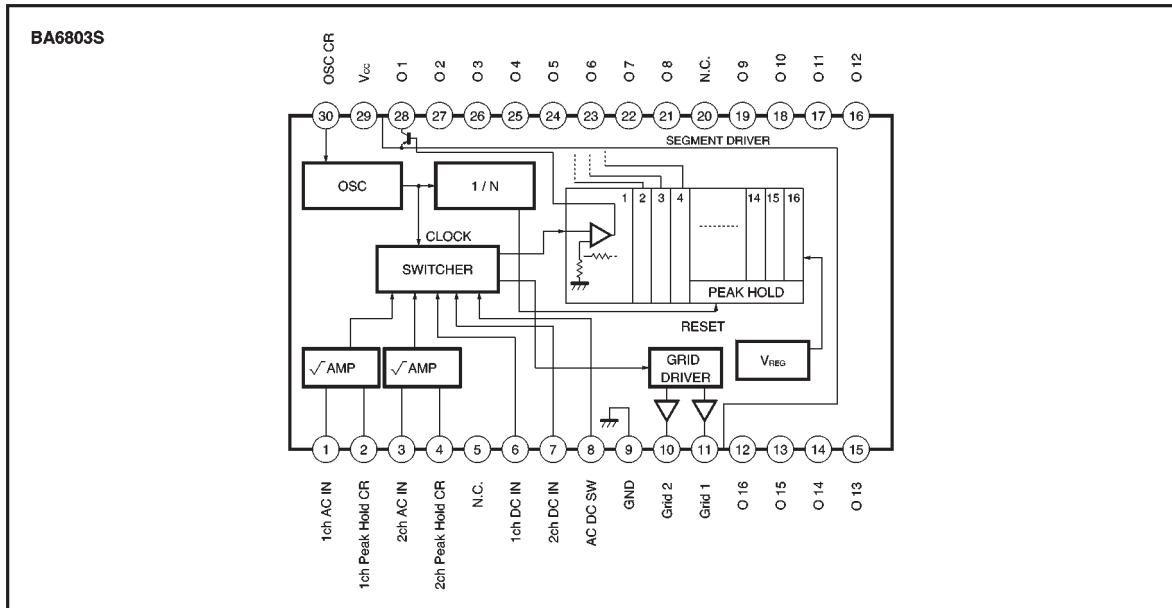
- 1) Uses dynamic-drive system to display two 16-point channels. 30-pin SDIP package.
- 2) AC and DC inputs provided. Switching function allows two-mode display.
- 3) Upper 12 points have peak hold function in AC mode (two seconds typ.).
- 4) Power-on mute function.
- 5) Dynamic-drive system reduces the power dissipation of the fluorescent display tube power supply.
- 6) Square root compression amplifier built in.

● Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V _{CC}	7.0	V
Power dissipation	P _D	1200*1	mW
Operating temperature	T _{OPR}	-20~+70	°C
Storage temperature	T _{STG}	-55~+125	°C
Output voltage	V _{CC} +V _{EE}	36	V

*1 Reduced by 12mW for each increase in Ta of 1°C over 25°C.

● Block diagram

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operating voltage range	V_{cc}	4.5	5.0	5.8	V	
Quiescent current	I_q	—	17	24	mA	—
AC input resistance	R_{INAC}	175	250	325	Ω	Pins 1 and 3
DC input resistance	R_{INDC}	7	10	13	$k\Omega$	—
Oscillator frequency	f_{osc}	1.7	2.0	2.3	kHz	$C=0.015\ \mu\text{F}$, $R=30\text{k}\Omega$
Peak hold time	T_{hold}	—	2	—	s	$f_{osc}=2\text{kHz}$
Output duty cycle	Duty	—	1 / 8	—	—	$f_{osc}=2\text{kHz}$
Grid output low level voltage	V_{GL}	—	0.4	0.8	V	$I_G=5\text{mA}$
Grid output leakage current	$I_{G\ leak}$	—	—	10	μA	$V_{cc}=5\text{V}$

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Segment output high level voltage	V_{OH}	3.7	4.0	—	V	$I_o=2\text{mA}$
Segment output leakage current	I_{oleak}	—	—	10	μA	$V_{EE}=-31\text{V}$
Input switching threshold	V_{TH}	2.2	2.5	2.8	V	
AC sensitivity	V_{INAC}	250	400	630	mV	$R_{IN} = 1.5\text{k}\Omega$ AC comparator 11 on level
Maximum grid output current	I_{GM}	5	—	—	mA	$V_{OL}=0.8\text{V}$
Maximum segment output current	I_{oM}	2	—	—	mA	$V_{OH}=3.7\text{V}$
AC comparator level 16	V_{C16AC}	9.0	10	12	dB	Pin 12 output
AC comparator level 15	V_{C15AC}	7.0	8	9	dB	Pin 13 output
AC comparator level 14	V_{C14AC}	5.0	6	7.0	dB	Pin 14 output
AC comparator level 13	V_{C13AC}	3.0	4	5.0	dB	Pin 15 output
AC comparator level 12	V_{C12AC}	1.0	2	3.0	dB	Pin 16 output
AC comparator level 11	V_{C11AC}	—	0	—	dB	Pin 17 output
AC comparator level 10	V_{C10AC}	-3.0	-2	-1.0	dB	Pin 18 output
AC comparator level 9	V_{C9AC}	-5.0	-4	-3.0	dB	Pin 19 output
AC comparator level 8	V_{C8AC}	-7.0	-6	-5.0	dB	Pin 21 output
AC comparator level 7	V_{C7AC}	-9.0	-8	-7.0	dB	Pin 22 output
AC comparator level 6	V_{C6AC}	-13	-11	-9.0	dB	Pin 23 output
AC comparator level 5	V_{C5AC}	-17.5	-15	-13	dB	Pin 24 output
AC comparator level 4	V_{C4AC}	-22.5	-20	-17.5	dB	Pin 25 output
AC comparator level 3	V_{C3AC}	-27	-25	-22.5	dB	Pin 26 output
AC comparator level 2	V_{C2AC}	-34	-30	-27	dB	Pin 27 output
AC comparator level 1	V_{C1AC}	-50	-40	-34	dB	Pin 28 output
DC comparator level 16	V_{C16DC}	2.84	3.18	3.52	V	Pin 12 output
DC comparator level 15	V_{C15DC}	2.55	2.87	3.19	V	Pin 13 output
DC comparator level 14	V_{C14DC}	2.27	2.55	2.83	V	Pin 14 output
DC comparator level 13	V_{C13DC}	1.98	2.26	2.52	V	Pin 15 output
DC comparator level 12	V_{C12DC}	1.79	2.03	2.27	V	Pin 16 output
DC comparator level 11	V_{C11DC}	1.56	1.82	2.08	V	Pin 17 output
DC comparator level 10	V_{C10DC}	1.31	1.64	1.97	V	Pin 18 output
DC comparator level 9	V_{C9DC}	1.15	1.49	1.83	V	Pin 19 output
DC comparator level 8	V_{C8DC}	1.00	1.33	1.66	V	Pin 21 output
DC comparator level 7	V_{C7DC}	0.95	1.19	1.43	V	Pin 22 output
DC comparator level 6	V_{C6DC}	0.80	1.03	1.26	V	Pin 23 output
DC comparator level 5	V_{C5DC}	0.60	0.82	1.02	V	Pin 24 output
DC comparator level 4	V_{C4DC}	0.45	0.63	0.81	V	Pin 25 output
DC comparator level 3	V_{C3DC}	0.33	0.48	0.63	V	Pin 26 output
DC comparator level 2	V_{C2DC}	0.25	0.37	0.49	V	Pin 27 output
DC comparator level 1	V_{C1DC}	0.10	0.20	0.30	V	Pin 28 output

Notes: (1) The value given above for AC comparator level is measured after 0dB point adjustment.

(2) DC comparator level $V_{C(n)DC}$ (Max.) > $V_{C(n+1)DC}$ (Min.), but when the nth comparator is off, the (n+1)th comparator is never on.

● Measurement circuit

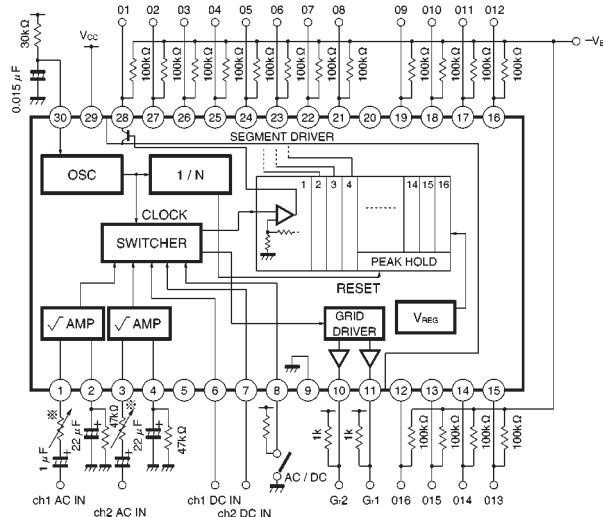


Fig. 1

● Application example

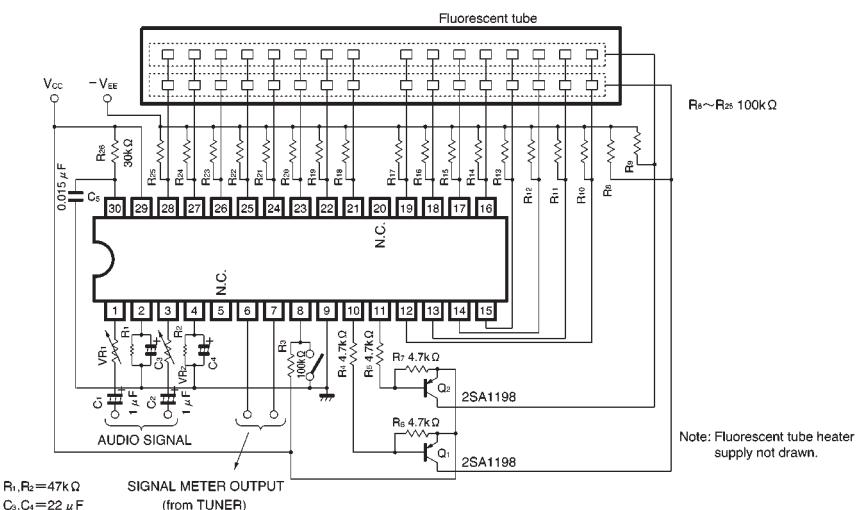


Fig. 2

●Circuit operation

(1) Input block

The AC input pins are pins 1 and 3, and the DC input pins are pins 6 and 7. Pin 8 is used to switch between the AC and DC inputs. When the input to pin 8 is "H", AC input is selected (pins 1 and 3).

Therefore, by using pin 8 to switch between the AC and DC modes, the IC can do two jobs, using one fluorescent tube. For example, pins 1 and 3 can be used for audio signal input, and pins 6 and 7 can be used as the input for the signal meter output from a tuner (DC). The AC input impedance of pins 1 and 3 is a low 250Ω (typ.), so connect potentiometers (VR_1 and VR_2) in series with the inputs to adjust the sensitivity and ch1 and ch2 balance.

(2) Peak hold circuit

The BA6803S features a peak hold circuit that temporarily holds peak signal levels in AC input mode.

The peak hold function can be used with the upper 12 points (5 to 16). The peak hold time depends on the oscillator frequency. It is 2 sec. (typ.) for an oscillator frequency of 2kHz.

DC mode does not have a peak hold function.

(3) Grid output

The pin 10 and 11 grid outputs are open-collector NPN transistors. The logic is active low (the fluorescent tube lights when the output is "L"), so connect two PNP transistors Q_1 and Q_2 as shown in the application example circuit to drive the fluorescent tubes (see Fig. 3).

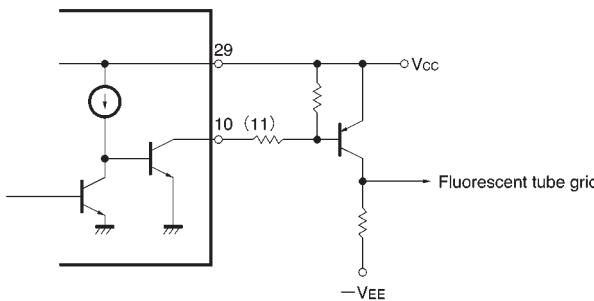


Fig. 3

(4) Segment output block

Pins 12 to 28 are the segment outputs. The output circuits are open-collector PNP transistors. When grid 1 is "L", the ch1 level is output (pin 1 or 6 input level), and when grid 2 is "L", the ch2 level is output (pin 3 or 7 input level). Refer to Fig. 4.

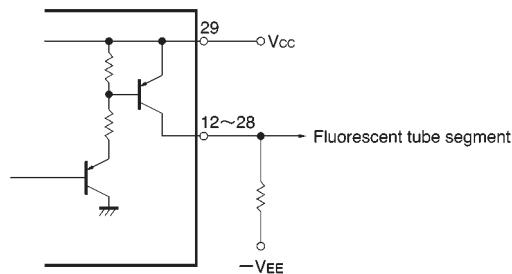


Fig. 4

(5) Grid and segment output timing chart. The grid and segment output timing is shown in Fig. 5.

(6) Attack and release times

The response characteristic for AC input signals is set by resistor R_1 and capacitor C_3 for ch1 and resistor R_2 and capacitor C_4 for ch2 (pins 2 and 4). When $R_1 = 47k\Omega$ and $C_3 = 22\mu F$, the attack time is about 4ms, and the release time is about 1sec. (same for ch2).

Attack time : Time for the voltage on pins 2 and 4 to rise from 1V to 2.5V when the input goes from no input to 2.6Vrms, then back to no input.

Release time : Time for the voltage on pins 2 and 4 to fall from 2.5V to 1V when the input goes from 2.6Vrms to no input.

(7) Oscillator frequency

The resistor R_{26} and capacitor C_5 connected to pin 30 determine the oscillator frequency. The oscillator frequency (f_{osc}) and grid output period (T) are related as follows:

$$T \text{ (ms)} = 16 / f_{osc} \text{ (kHz)}$$

● Timing chart

BA6803S (when oscillator frequency is 2kHz)

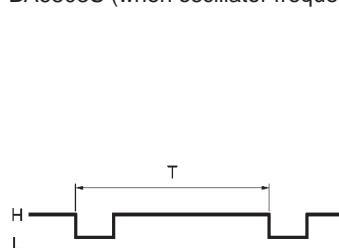


Fig. 5 (a)

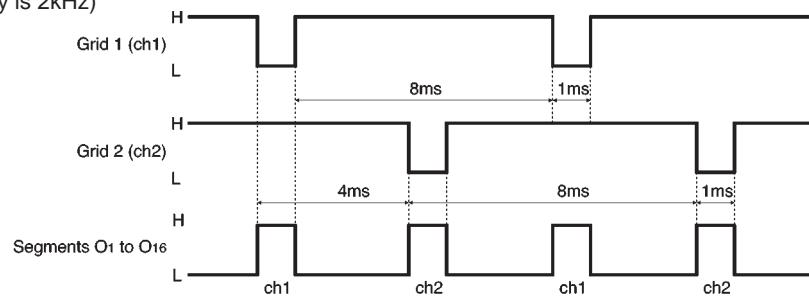


Fig. 5 (b)

● Attached components (refer to "Circuit operation")

C₁ and C₂ : input coupling capacitors.

VR₁ and VR₂ : AC sensitivity adjustment and balance adjustment (3kΩ recommended).

C₃, R₁, C₄ and R₂ : set the response characteristics with respect to the AC input signal. In the example given, the attack time is about 4mS and the release time is about 1sec.

R₃ : Pullup resistor for the input switching terminal (pin 8).

R₆ and R₇ : resistor for the grid leak current path (I_{leak}). Set so that I_{leak} × R₆ (R₇) < 0.6V.

R₄ and R₅ : base bias resistors for Q₁ and Q₂.

Conditions for base bias current (I_B) flow are V_{CC} = 5V and V_F = 0.6V:

$$\frac{R_4}{R_6} < \frac{5 - 0.6}{0.6} = 7.3$$

the base current is given by the following formula.

$$I_B \text{ (mA)} \doteq \frac{5 - 0.6}{R_4 \text{ (k}\Omega\text{)}} - \frac{0.6}{R_6 \text{ (k}\Omega\text{)}}$$

$$I_B > \frac{\text{Fluorescent tube grid current}}{h_{FE}}$$

Set resistors R₄ and R₆ (R₅ and R₇) so that

Q₁ and Q₂ : grid output inverting transistors. Use transistors for which V_{CEO} > V_{CC} + V_{EE}.

R₈ to R₂₅ : Resistors that reverse bias the segments and grid when the fluorescent tube is not lit. The application example given is for general cases. Select the resistors to suit the characteristics of the fluorescent tube used.

C₅ and R₂₆ : set the oscillator frequency.

Capacitor C₅ should be a component with good temperature characteristics.

● Operation notes

1) Adjust the potentiometers VR₁ and VR₂ (connected to pins 1 and 3) to adjust the 0dB input level and the dispersion of ch1 and ch2.

2) The temperature characteristic for the lighting limit for the 16th LED is shown in Fig. 6.

3) The external resistor R₂₆ connected to the oscillator (pin 30) should be in the range of 20kΩ and 100kΩ. If it is outside this range, oscillation may stop due to the influence of temperature (see Fig. 7).

● Electrical characteristics curves

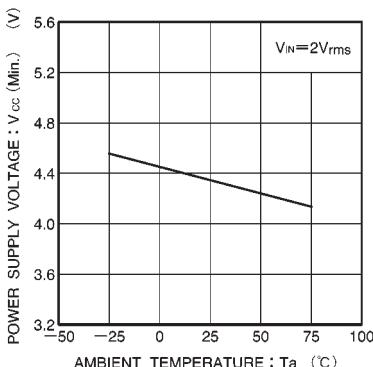


Fig. 6 16th point lighting limit power supply voltage vs. ambient temperature

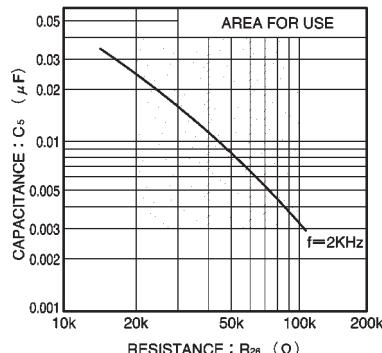


Fig. 7 Value of external components for oscillator ($V_{cc} = 5.0\text{V}$)

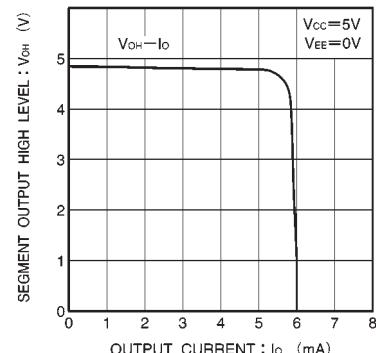


Fig. 8 Segment high level output vs. output current

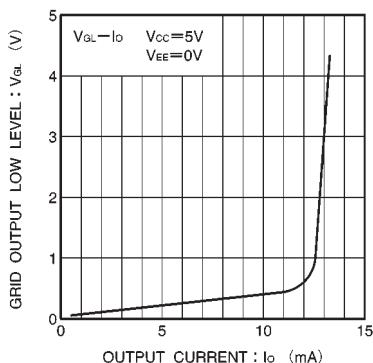


Fig. 9 Grid lowlevel output vs. output current

● External dimensions (Units: mm)

