

LED level meter driver, 12-point, power scale, dot or bar display

BA683A

The BA683A is a monolithic IC for LED power meter applications. The display level range is 9mV_{rms} to $380\text{mV}_{\text{rms}}$ (Typ.) divided into 12 points with interval spacings of 3dB. The constant current outputs can be set using an external resistor.

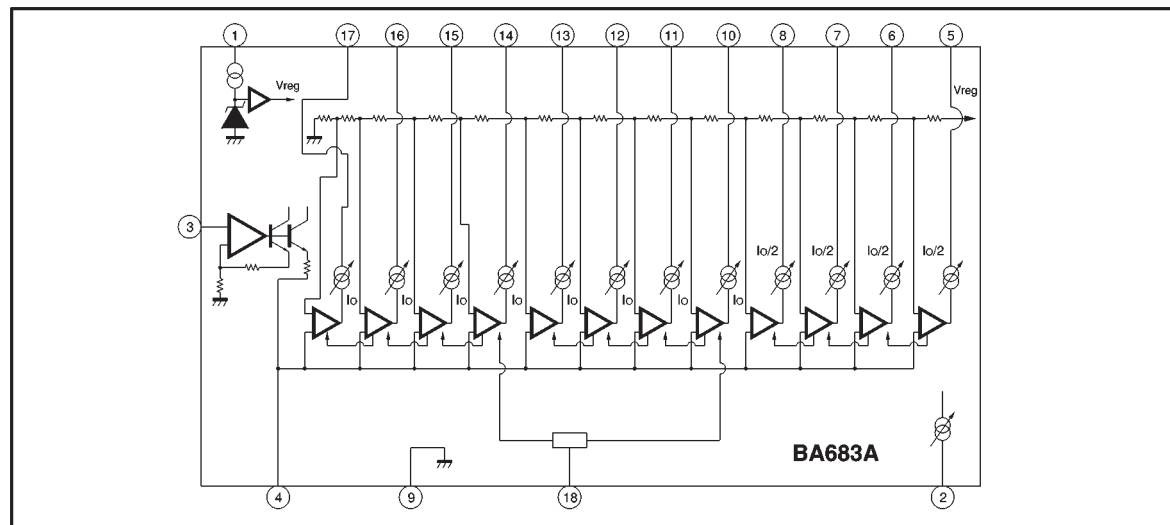
●Applications

Level meters for all types of audio equipment applications

●Features

- 1) 12-point power meter driver for bar / dot displays.
- 2) Fixed-current outputs that can directly drive LEDs.
- 3) Output current can be set using external resistors allowing different types of LEDs to be used in combination.
- 4) Built-in half-wave rectifier amplifier.
- 5) With bar-type display, by connecting four LEDs in series, power dissipation is reduced.

●Block diagram



● Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage	V _{CC}	15	V
Power dissipation	P _d	1100*	mW
Operating temperature	T _{opr}	−25~+75	°C
Storage temperature	T _{stg}	−55~+125	°C

* Reduced by 11.0mW for each increase in Ta of 1°C over 25°C.

● Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 12V, and f = 1kHz)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
Power supply voltage	V _{CC}	10	12	14	V	When V _{F(LED)} =2V	Fig.1
Quiescent current	I _Q	—	5	10	mA	V _{IN} =0V	Fig.1
LED current setting range	I _{LED}	—	—	20	mA	Set using R ₁ (see Fig. 3)	Fig.1
Pin 5 LED current	I _{LED}	6.0	8.0	10	mA	R ₁ =27kΩ	Fig.1
Pin 5 to 8 LED current deviation	ΔI _{LED}	−1.0	0	1.0	mA	R ₁ = 27kΩ With respect to the pin 5 I _{LED} value.	Fig.1
Pin 17 LED current	I _{LED}	12	15	18	mA	R ₁ =27kΩ	Fig.1
Pin 10 to 17 LED current deviation	ΔI _{LED}	−2.0	0	2.0	mA	R ₁ = 27kΩ With respect to the pin 17 I _{LED} value.	Fig.1
Sensitivity	V _{IN}	130	190	260	mV _{rms}	On level for comparator 10.	Fig.1
Comparator level 1	V _{C1}	—	−27	—	dB	Pin 17 output (use VR ₁ to adjust the offset)	Fig.1
Comparator level 2	V _{C2}	−25.5	−24	−22.5	dB	Pin 16 output	Fig.1
Comparator level 3	V _{C3}	−22.5	−21	−19.5	dB	Pin 15 output	Fig.1
Comparator level 4	V _{C4}	−19.5	−18	−16.5	dB	Pin 14 output	Fig.1
Comparator level 5	V _{C5}	−16.5	−15	−13.5	dB	Pin 13 output	Fig.1
Comparator level 6	V _{C6}	−13.5	−12	−10.5	dB	Pin 12 output	Fig.1
Comparator level 7	V _{C7}	−10.5	−9	−7.5	dB	Pin 11 output	Fig.1
Comparator level 8	V _{C8}	−7.0	−6	−5.0	dB	Pin 10 output	Fig.1
Comparator level 9	V _{C9}	−4.0	−3	−2.0	dB	Pin 8 output	Fig.1
Comparator level 10	V _{C10}	—	0	—	dB	Pin 7 output (V _{C10} level is 0dB)	Fig.1
Comparator level 11	V _{C11}	2.0	3	4.0	dB	Pin 6 output	Fig.1
Comparator level 12	V _{C12}	4.5	6	7.5	dB	Pin 5 output	Fig.1

●Measurement circuit

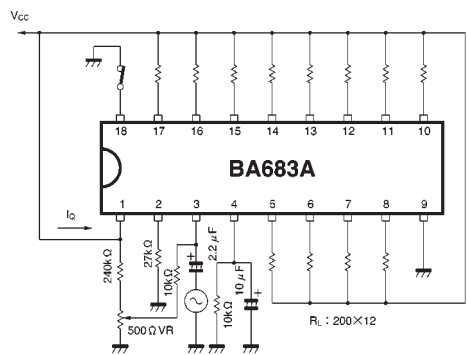


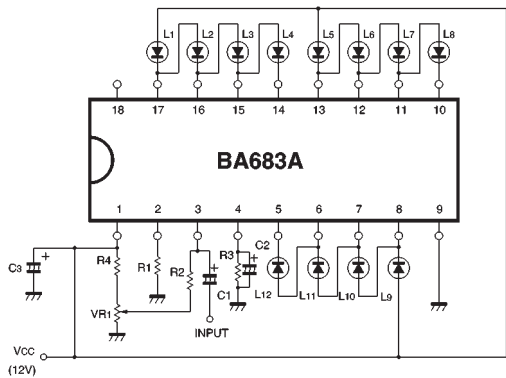
Fig. 1

●Comparator level vs. AC and DC input levels

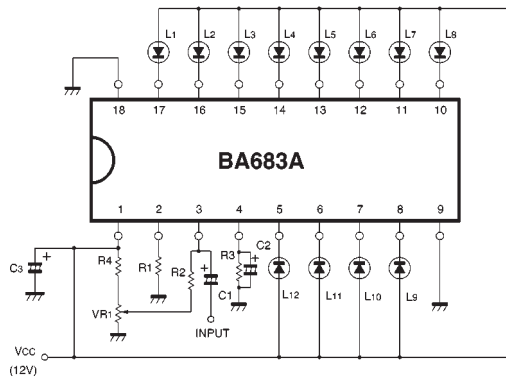
Comparator level V _c	1	2	3	4	5	6	7	8	9	10	11	12
dB display (dB)	−27	−24	−21	−18	−15	−12	−9	−6	−3	0	+3	+6
AC input level (mV _{rms})	8.5	12	17	24	34	48	67	95	135	190	268	379
DC input level (mV)	11	16	22	31	44	62	88	124	175	247	349	493

* These values are not guaranteed. Use for reference only.

●Application example



(1) Bar display connections



(2) Dot display connections

Note: Ensure that the voltage on the LED current output pins (5 to 8 and 10 to 17) is always 2V or more. If the voltage is below 2V, the current may drop significantly. Take particular care when using high V_F LEDs in bar display applications.

Recommended values
R₁ = 27kΩ (green LED) or 39 to 47kΩ (red LED)
R₂ = 10kΩ, C₁ = 2.2 μF
R₃ = 10kΩ, C₂ = 10 μF
R₄ = 240kΩ, C₃ = 10 μF
VR₁ = 500Ω
(these values are the same for both bar and dot display)

Fig. 2

●Attached components

(1) LED current setting resistor (R_1)

This resistor sets the LED current value. Refer to Fig. 3 for the relationship between the value of this resistor and the current value. The ratio of the current for outputs 1 to 8 and 9 to 12 is about 2: 1. The recommended value is for this resistor is 27k Ω . If the LED current is set too high, the allowable power dissipation of the package may be exceeded, so exercise due caution.

(2) Input coupling capacitor (C_1)

This capacitor connects the BA683A to external input circuits. The recommended value is 2.2 μ F.

(3) Input bias resistor (R_2)

This resistor is the input impedance. If the value is set too large, the DC bias voltage will increase, and the input offset will increase and have an effect on the comparators. The recommended value is 10k Ω .

(4) Resistor and capacitor that set the LED operation level discharge time constant (R_3 and C_2)

These components set the discharge time constant for LED operation level. The recommended values are $R_3 = 10$ k Ω and $C_2 = 10$ μ F.

(5) Input offset adjustment resistors (R_4 and VR_1)

These resistors are used to adjust the input offset for the rectifier amplifier. The recommended values are $R_4 = 240$ k Ω , and $VR_1 = 500$ Ω . If the value of VR_1 is too high, adjustment becomes difficult, and if it is too small, adjustment may not be possible.

(6) Power supply capacitor (C_3)

This capacitor stabilizes the power supply line. The recommended value is 10 μ F. This capacitor will have no effect if its value is 1 μ F or less.

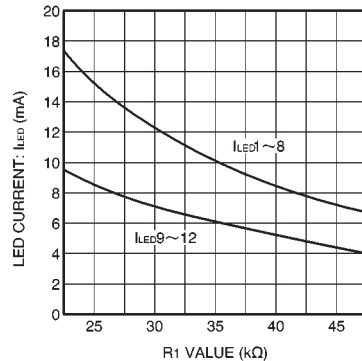


Fig. 3 LED current vs. R_1 setting

●Operation notes

(1) LED connection

Connect the LEDs as indicated in Fig. 2 (1) and Fig 2 (2). Note that the connection methods are different for bar and dot displays, and that in the case of bar display, pin 18 is open, while for dot display, pin 18 is connected to GND.

For the BA683A, the ratio of the current for LEDs L_1 to L_8 and L_9 to L_{12} is about 2: 1. If you want the current ratio for some of the L_1 to L_8 LEDs to be 1, reduce the current by connecting a resistance in parallel with the LED. Short any LED that are unused. Connect the LEDs that are not used from the lowest level LED (except when the 12th LED is not used for display alignment).

(2) LED current adjustment

The LED current is set using R_1 . The relationship between the value of R_1 and the typical LED current is given in Fig. 3.

(3) Comparator voltage

In the case of the BA683A, the comparator voltage is the input voltage when about half LED current setting value (Typ.) starts flowing in an LED.

Therefore, if the LED current is set to 16mA, when the third LED starts to light and 8mA is flowing in the LED, this input voltage is the third comparator voltage.

(4) 0dB and input offset adjustment

First, adjust the input signal so that the 10th LED lights. This is the 0dB input signal level. Next, lower the input signal level to -27dB, and adjust the offset adjustment potentiometer VR_1 so that the first LED lights. Repeat the 0dB and -27dB adjustments alternately to accurately set the levels. The input level at which an LED lights is the comparator voltage.

(5) Earthing

The BA683A GND (pin 9) and the external component earths should be connected together at one point.

● External dimensions (Units: mm)

