

**LB1409****Level Meter Driver for 9 LEDs****Applications**

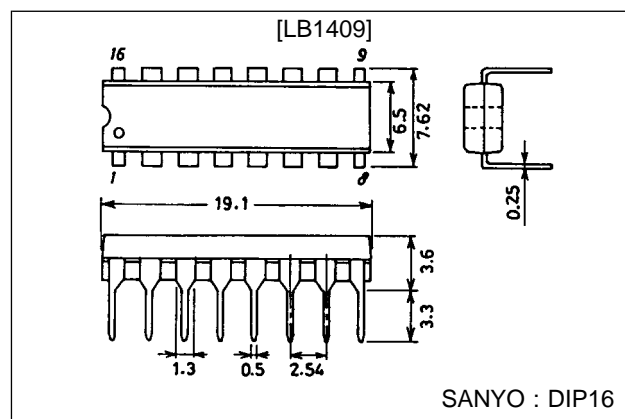
- AC level meters such as VU meters.
- DC level meters such as signal meters.

**Functions**

- Display  
Nine red or green LEDs display the input level in the shape of a bar.
- Input amplifier  
Wide application is available owing to built-in DC amplifier whose gain is variable with external resistors.
- Comparator level  
Setting is made by steps of 3 dB as follows.  
-18 dB, -15 dB, -12 dB, -9 dB, -6 dB, -3 dB, 0 dB, +3 dB, +6 dB
- Supply voltage  
The recommended supply voltage range is so wide as 5.5 V to 16 V.  
(If pin Vref 2 is used, 7 V to 16 V.)
- Reference voltage  
Constant voltage output is available with external transistor owing to pin Vref 2 = 5 V.

**Package Dimensions**

unit : mm

**3064-DIP16****Specifications****Comparator Level OUT Pin Voltage at  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 12\text{ V}$ ,  $V_{ref 1} = 3\text{ V}$** 

Comparator level	Pin No.	min	typ	max	Unit
D1	7	0.11	0.18*	0.25	V
D2	8	0.20	0.27*	0.34	V
D3	9	0.30	0.38*	0.46	V
D4	10	0.45	0.53*	0.61	V
D5	11	0.66	0.75	0.84	V
D6	12	0.97	1.06	1.15	V
D7	13	1.40	1.50	1.60	V
D8	14	2.02	2.12	2.22	V
D9	15	2.90	3.00	3.10	V

\*: No overlap occurs in each individual IC.

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### Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>CC</sub> max	Pin 1	-0.3 to +18	V
Input voltage	V <sub>IN</sub>	Pin 3, 4	-0.3 to V <sub>CC</sub>	V
D1 to D9 output voltage	V <sub>OUT</sub> (D)	D1 to D9 off	-0.3 to +18	V
D1 to D9 output current	I <sub>OL</sub> (D)	Pin 7 to 15, D1 to D9 on	+30	mA
First reference flow-out current	I <sub>ref</sub> (1)	Pin 2	-1 to 0	mA
Second reference flow-out current	I <sub>ref</sub> (2)	Pin 16	-6 to 0	mA
V <sub>OUT</sub> supply voltage	V <sub>OUT</sub>	Pin 5	-0.3 to +6	V
Allowable power dissipation	Pd max	Ta = 55°C	500	mW
Operating temperature	T <sub>opr</sub>		-10 to +60	°C
Storage temperature	T <sub>stg</sub>		-40 to +125	°C

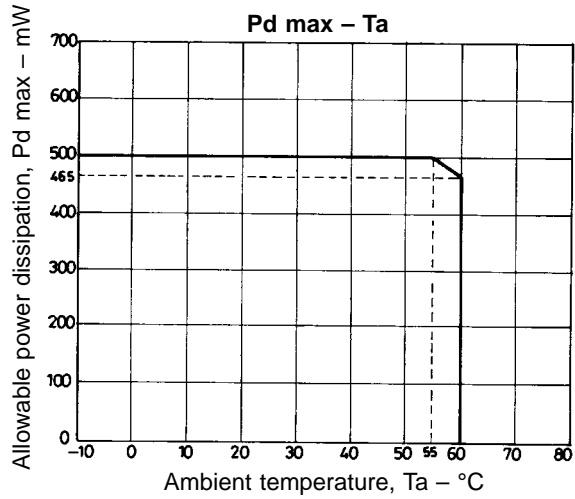
### Allowable Operating Ranges at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V <sub>CC</sub>	Pin 1, ( ): Using V <sub>ref</sub> 2	+5.5 to +16	V
			(+7 to +16)	V
Input voltage	V <sub>IN</sub> <sup>+</sup> or V <sub>IN</sub> <sup>-</sup>	Pin 3 or Pin 4	-0.3 to +V <sub>CC</sub>	V
Output pin load resistance	R <sub>L</sub>	Between pin 5 OUT and pin 6 GND.	15 k to 20 k	Ω

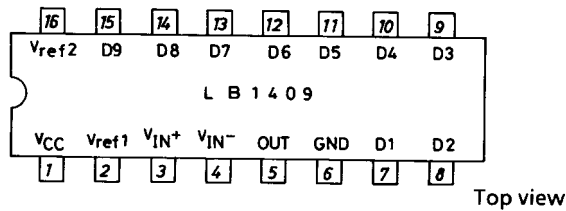
### Electrical Characteristics at Ta = 25°C, V<sub>CC</sub> = 12 V

Parameter	Symbol	Conditions	min	typ	max	Unit
Input bias current (Amplifier)	I <sub>IN</sub> <sup>+</sup> (A)	Pin 3, V <sub>IN</sub> <sup>+</sup> = 0 V, V <sub>IN</sub> <sup>-</sup> = 3 V, GND = 0 V	-2		0	μA
	I <sub>IN</sub> <sup>-</sup> (A)	Pin 4, V <sub>IN</sub> <sup>+</sup> = 3 V, V <sub>IN</sub> <sup>-</sup> = 0 V, GND = 0 V	-2		0	μA
Input bias current (Comparator) + Output leakage current	I <sub>IN</sub> <sup>+</sup> (C) <sup>+</sup> I <sub>OL</sub> (A)	Pin 5, V <sub>IN</sub> <sup>+</sup> = 0 V, V <sub>IN</sub> <sup>-</sup> = 3 V, OUT = 0 V, GND = 0 V	-10		0	μA
Offset voltage (1)	V <sub>offset</sub> (1)	Pin 5, V <sub>CC</sub> = 6 V, V <sub>IN</sub> <sup>+</sup> = V <sub>IN</sub> <sup>-</sup> = 0 V, GND = -6 V, GAIN = 20 dB	-180		+180	mV
Offset voltage (2)	V <sub>offset</sub> (2)	Pin 5, V <sub>IN</sub> <sup>+</sup> = V <sub>IN</sub> <sup>-</sup> = 0 V, GND = 0 V, GAIN = 20 dB	0		+180	mV
First reference voltage	V <sub>ref</sub> (1)	Pin 2, I <sub>ref</sub> = 0 to 1 mA	2.6		3.0	V
Second reference voltage	V <sub>ref</sub> (2)	Pin 16, I <sub>ref</sub> = 0 to 6 mA	4.2	4.7	5.2	V
Current drain	I <sub>CC</sub>	Pin 1, V <sub>IN</sub> <sup>+</sup> = 3 V, V <sub>IN</sub> <sup>-</sup> = 0 V		10	20	mA
Amplifier gain	V <sub>G</sub>	Open loop	30			dB
Output flow-out current	I <sub>OH</sub>	Pin 5, V <sub>IN</sub> <sup>+</sup> = 3 V, V <sub>IN</sub> <sup>-</sup> = 0 V, V <sub>OUT</sub> = 0 V			-10	mA
D pin output ON voltage	V <sub>OL</sub> (D)	Pin 7 to 15, D1 to D9, I <sub>OL</sub> = 20 mA, V <sub>IN</sub> <sup>+</sup> = 3 V, V <sub>IN</sub> <sup>-</sup> = 0 V			1.2	V
D pin output leak current	I <sub>OH</sub> (D)	Pin 7 to 15, D1 to D9, V <sub>IN</sub> <sup>+</sup> = 0 V, V <sub>IN</sub> <sup>-</sup> = 3 V, V <sub>D1 to D9</sub> = 12 V			10	μA
Output voltage (Amplifier)	V <sub>OH</sub>	Pin 5, V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> <sup>+</sup> = 3 V, V <sub>IN</sub> <sup>-</sup> = 0 V, R <sub>L</sub> = 15 kΩ	4			V
		Pin 5, V <sub>CC</sub> = 12 V, V <sub>IN</sub> <sup>+</sup> = 3 V, V <sub>IN</sub> <sup>-</sup> = 0 V, R <sub>L</sub> = 15 kΩ	9.5			V

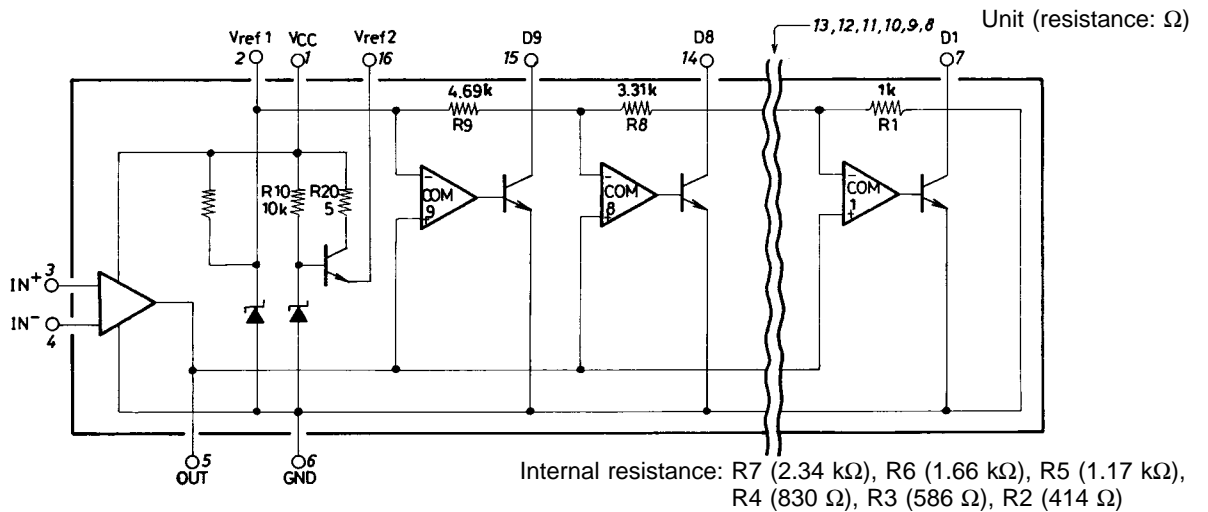
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## Pin Assignment



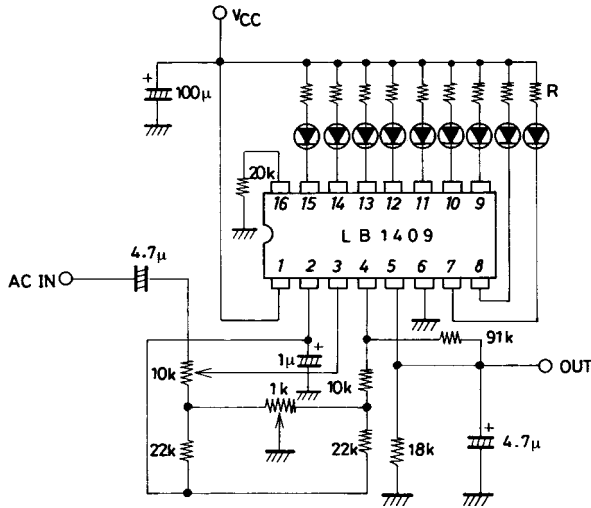
## Equivalent Circuit



Sample Application Circuits

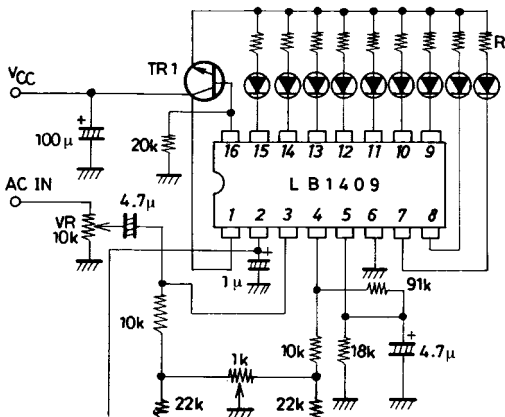
(All with offset adjustment)

• Circuit not using Vref 2



Unit (resistance: Ω, capacitance: F)

• Circuit using Vref 2



Unit (resistance: Ω, capacitance: F)

Adjusting procedures

1. Turn the center of 10 kΩ VR largely to 4.7 µF capacitor side.
2. Input AC signal of 50/√2 mV from AC IN.
3. Adjust 1 kΩ VR so that the output at OUT becomes 500 mV DC.

Equation used in the calculation of R to be inserted in series with LED.

Gain : 20 dB

$$R (\text{red}) = (V_{CC} - 2.5) / 6 \text{ k}\Omega$$

$$R (\text{green}) = (V_{CC} - 2.8) / 18 \text{ k}\Omega$$

Adjusting procedures

- R to be inserted in series with LED is as follows irrespective of V<sub>CC</sub>.  
 $R (\text{red}) = 360 \Omega$  (Approx. 6 mA)  
 $R (\text{green}) = 100 \Omega$  (Approx. 18 mA)
- TR1 should be chosen with P<sub>C</sub> considered; and the following transistors are recommended.  
 Red LED drive 2SD400  
 Green LED drive 2SD325

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