



# LB1409

## Level Meter Driver for 9 LEDs

### Applications

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

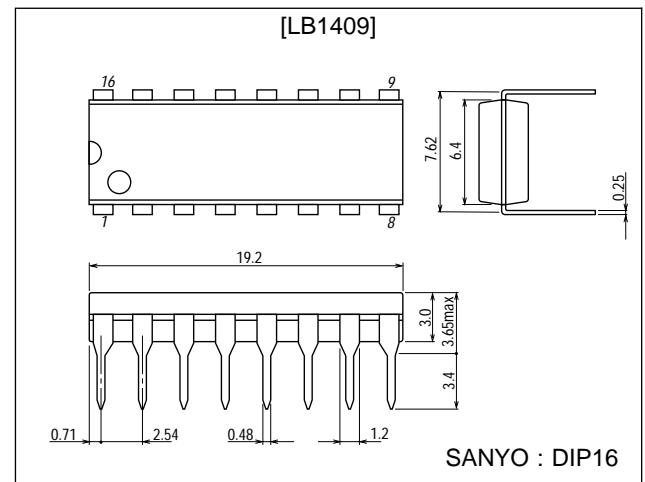
### Functions

- 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

#### 3006B-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

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53096HA(II)/8237KI/8205MW/7140KI, TS No.683-1/5

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Comparator level	Pin No.	min	typ	max	Unit
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.

### Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC}$ max	Pin 1	-0.3 to +18	V
Input voltage	$V_{IN}$	Pin 3, 4	-0.3 to $V_{CC}$	V
D1 to D9 output voltage	$V_{OUT}$ (D)	D1 to D9 off	-0.3 to +18	V
D1 to D9 output current	$I_{OL}$ (D)	Pin 7 to 15, D1 to D9 on	+30	mA
First reference flow-out current	$I_{ref}$ (1)	Pin 2	-1 to 0	mA
Second reference flow-out current	$I_{ref}$ (2)	Pin 16	-6 to 0	mA
$V_{OUT}$ supply voltage	$V_{OUT}$	Pin 5	-0.3 to +6	V
Allowable power dissipation	$P_d$ max	$T_a = 55^\circ\text{C}$	500	mW
Operating temperature	$T_{opr}$		-10 to +60	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +125	$^\circ\text{C}$

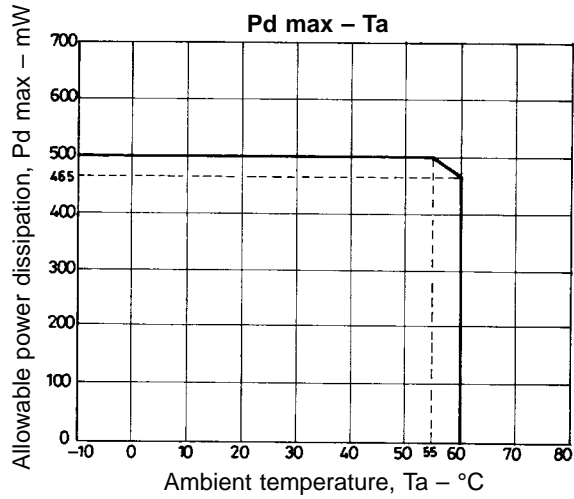
### Allowable Operating Ranges at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	$V_{CC}$	Pin 1, ( ) : Using $V_{ref}$ 2	+5.5 to +16	V
			(+7 to +16)	V
Input voltage	$V_{IN}^+$ or $V_{IN}^-$	Pin 3 or Pin 4	-0.3 to $V_{CC}$	V
Output pin load resistance	$R_L$	Between pin 5 OUT and pin 6 GND.	15 k to 20 k	$\Omega$

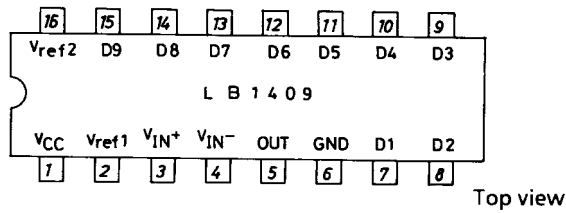
### Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 12\text{ V}$

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

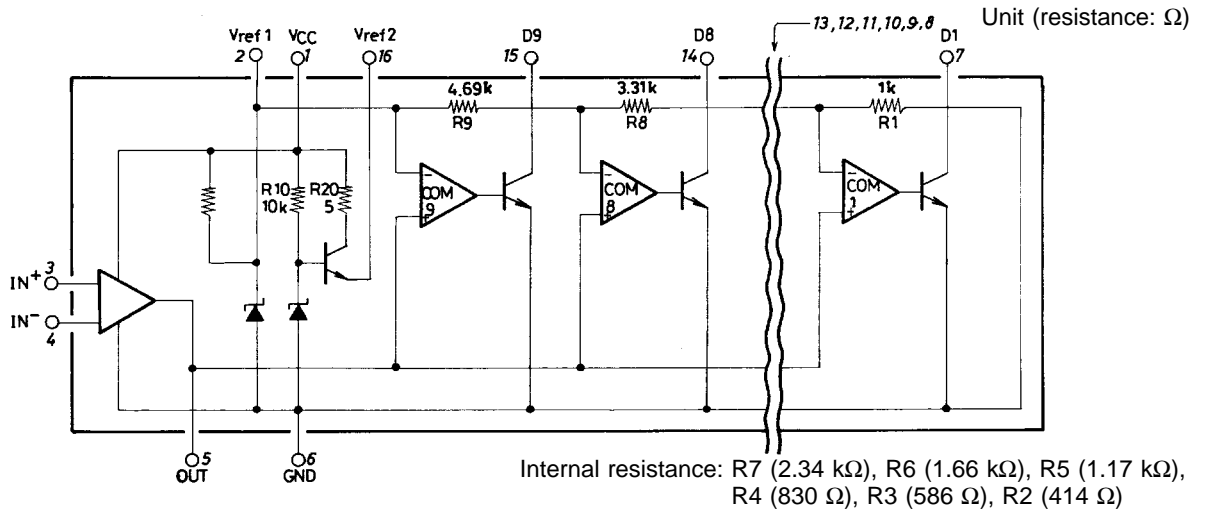
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## Pin Assignment



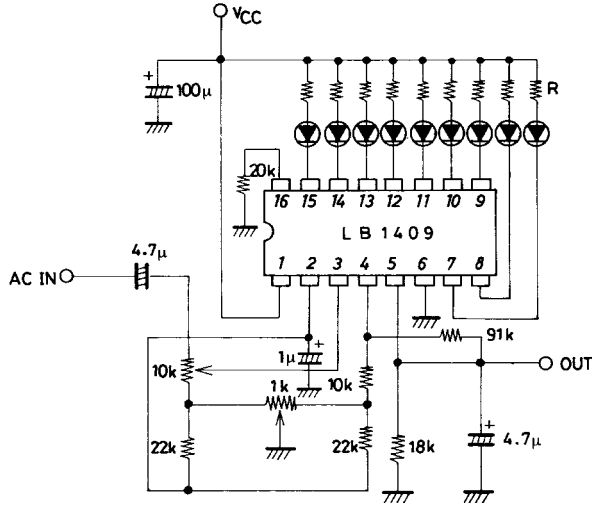
## Equivalent Circuit



Sample Application Circuits

(All with offset adjustment)

• Circuit not using Vref 2



Unit (resistance: Ω, capacitance: F)

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.

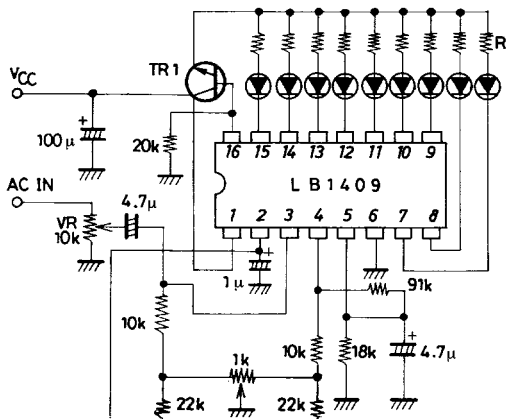
Equation used in the calculation of R to be inserted in series with LED.

Gain : 20 dB

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

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

• Circuit using Vref 2



Unit (resistance: Ω, capacitance: F)

Adjusting procedures

- R to be inserted in series with LED is as follows irrespective of V<sub>CC</sub>.

$$R (\text{red}) = 360 \Omega (\text{Approx. } 6 \text{ mA})$$

$$R (\text{green}) = 100 \Omega (\text{Approx. } 18 \text{ mA})$$

- 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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