



LB1409 — Monolithic Digital IC 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.
-18dB, -15dB, -12dB, -9dB, -6dB, -3dB, 0dB, +3dB, +6dB
- Supply voltage The recommended supply voltage range is so wide as 5.5V to 16V.
(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 = 5V

Specifications

Comparator Level OUT Pin Voltage at $T_a = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $V_{ref1} = 3\text{V}$

Comparator level	Pin No.	Ratings			Unit
		min	typ	max	
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 _{CC} max	Pin 1	-0.3 to +18	V
Input voltage	V _{IN}	Pin3, 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
VO _{UT} supply voltage	V _{OUT}	Pin 5	-0.3 to +6	V
Allowable power dissipation	P _d max	Ta = 55°C	500	mW
Operating temperature	T _{opr}		-10 to 60	°C
Storage temperature	T _{stg}		-40 to +125	°C

Allowable Operating Ranges at Ta = 25°C, V_{CC} = 5V

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	V _{CC}	Pin 1	+5.5 to +16	V
		Pin1, Using V _{ref} 2	+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 to 20	kΩ

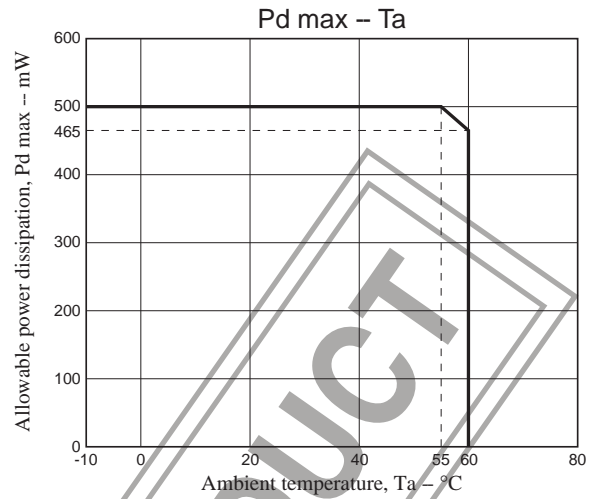
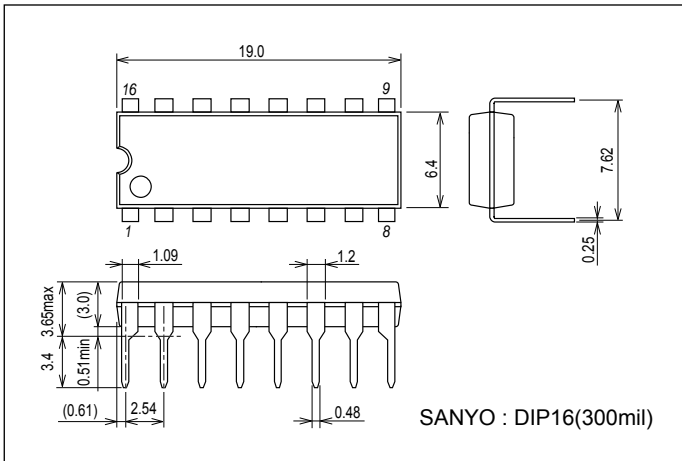
Electrical Characteristics at Ta = 25°C, V_{CC} = 12V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Input bias current (Amplifier)	I _{IN} ⁺ (A)	Pin 3, V _{IN} ⁺ = 0V, V _{IN} ⁻ = 3V, GND = 0V	-2		0	μA
	I _{IN} ⁻ (A)	Pin 4, V _{IN} ⁺ = 3V, V _{IN} ⁻ = 0V, GND = 0V	-2		0	μA
Input bias current (Comparator) + Output leakage current	I _{IN} ⁺ (C) +I _{OL} (A)	Pin 5, V _{IN} ⁺ = 0V, V _{IN} ⁻ = 3V, OUT = 0V, GND=0V	-10		0	μA
Offset voltage (1)	V _{offset} (1)	Pin 5, V _{CC} = 6V, V _{IN} ⁺ = V _{IN} ⁻ = 0V, GND = -6V, GAIN = 20dB	-180		+180	mV
Offset voltage (2)	V _{offset} (2)	Pin 5, V _{IN} ⁺ = V _{IN} ⁻ = 0V, GND = 0V, GAIN = 20dB	0		180	mV
First reference voltage	V _{ref} (1)	Pin 2, I _{ref} = 0 to 1mA	2.6		3.0	V
Second reference voltage	V _{ref} (2)	Pin 16, I _{ref} = 0 to 6mA	4.2	4.7	5.2	V
Current drain	I _{CC}	Pin 1, V _{IN} ⁺ = 3V, V _{IN} ⁻ = 0V		10	20	mA
Amplifier gain	V _G	Open loop	30			dB
Output flow-out current	I _{OH}	Pin 5, V _{IN} ⁺ = 3V, V _{IN} ⁻ = 0V, V _{OUT} = 0V			-10	mA
D pin output ON voltage	V _{OL} (D)	Pin 7 to 15, D1 to D9, I _{OL} = 20mA, V _{IN} ⁺ = 3V, V _{IN} ⁻ = 0V			1.2	V
D pin output leak current	I _{OH} (D)	Pin 7 to 15, D1 to D9, V _{IN} ⁺ = 0V, V _{IN} ⁻ = 3V, V _{D1} to D ₉ = 12V			10	μA
Output voltage (Amplifier)	V _{OH}	Pin 5, V _{CC} = 5.5V, V _{IN} ⁺ = 3V, V _{IN} ⁻ = 0V, R _L = 15kΩ	4			V
		Pin 5, V _{CC} = 12V, V _{IN} ⁺ = 3V, V _{IN} ⁻ = 0V, R _L = 15kΩ	9.5			V

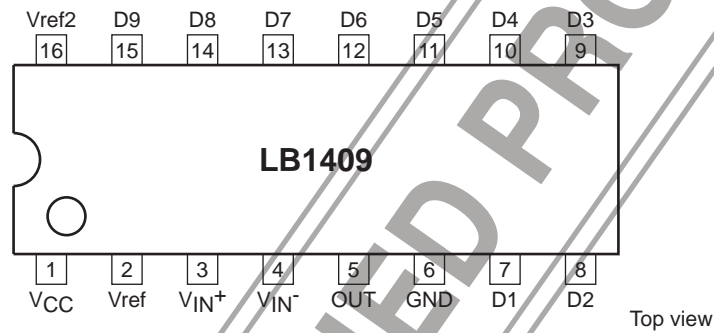
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Package Dimensions

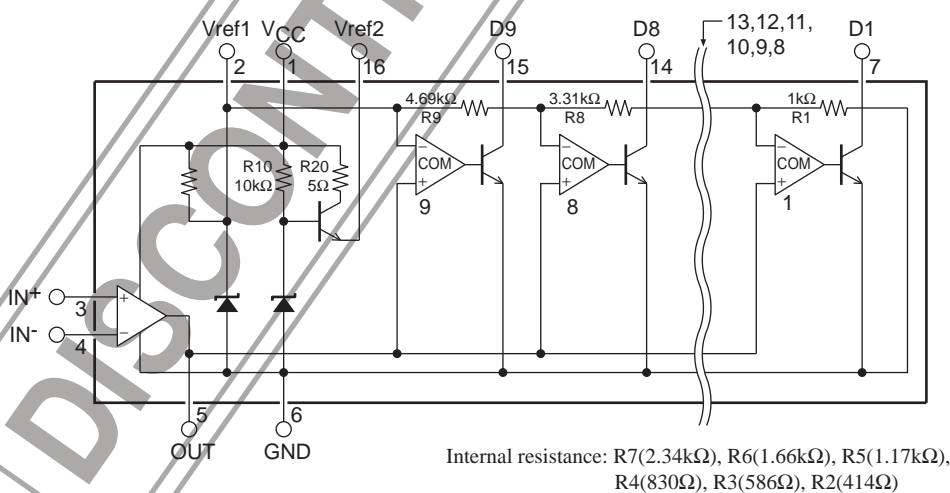
unit : mm (typ)
3006C



Pin Assignment

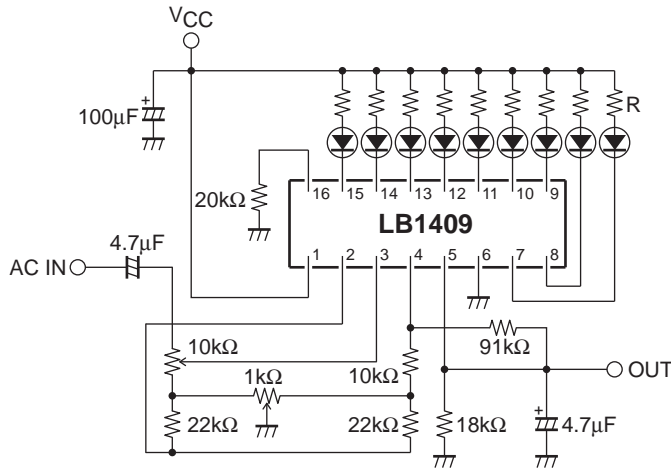


Equivalent Circuit



Application Circuit Example (All with offset adjustment)

- Circuit not using Vref 2



Adjusting procedures

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

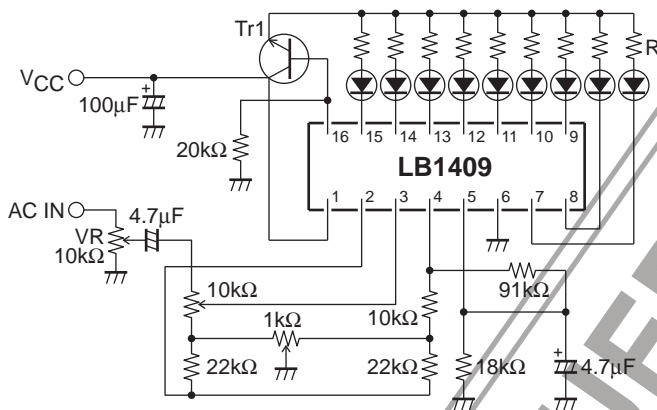
Equation used in the calculation of R to be inserted in series with LED.

Gain : 20dB

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

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

- Circuit using Vref 2



Adjusting procedures

- R to be inserted in series with LED is as follows irrespective of VCC.

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

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

- Tr1 should be chosen with PC considered; and the following transistors are recommended.

Red LED drive 2SD400

Green LED drive 2SD325

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