Ordering number : EN683E

SANYO Semiconductors
DATA SHEET

Monolithic Digital IC

# 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. -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 Ta = 25°C, $V_{CC}$ = 12V, Vref1 = 3V

| 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.



SANYO Semiconductor Co., Ltd.
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

## 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 | Iref (1) | Pin 2 | -1 to 0 | mA |
| Second reference flow-out current | Iref (2) | Pin 16 | -6 to 0 | mA |
| VOUT supply voltage | $V_{OUT}$ | Pin 5 | -0.3 to +6 | V |
| Allowable power dissipation | Pd max | Ta = 55°C | 500 | mW |
| Operating temperature | Topr | | -10 to 60 | °C |
| Storage temperature | Tstg | | -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 Vref2 | +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 |

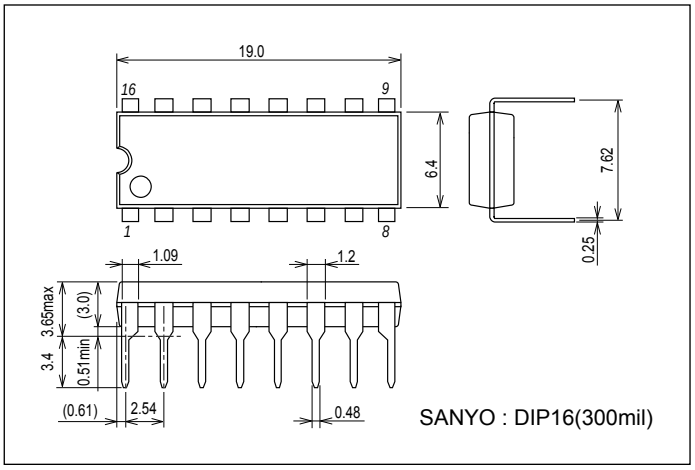
## Electrical Characteristics at Ta = 25°C, $V_{CC}$ = 12V

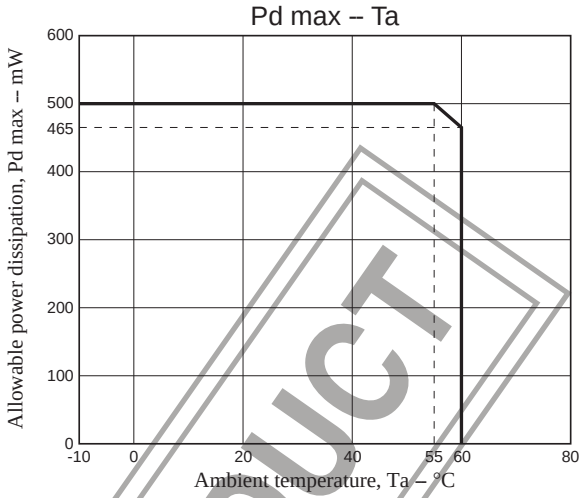
| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Input bias current (Amplifier) | $I_{IN}^+$ (A) | Pin 3, $V_{IN}^+$ = 0V, $V_{IN}^-$ = 3V, GND = 0V | -2 | | 0 | μA |
| | $I_{IN}^-$(A) | Pin 4, $V_{IN}^+$ = 3V, $V_{IN}^-$ = 0V, GND = 0V | -2 | | 0 | μA |
| Input bias current (Comparator) + Output leakage current | $I_{IN}^+$ (C) +IOL (A) | Pin 5, $V_{IN}^+$ = 0V, $V_{IN}^-$ = 3V, OUT = 0V, GND=0V | -10 | | 0 | μA |
| Offset voltage (1) | Voffset (1) | Pin 5, $V_{CC}$ = 6V, $V_{IN}^+$ = $V_{IN}^-$ = 0V, GND = -6V, GAIN = 20dB | -180 | | +180 | mV |
| Offset voltage (2) | Voffset (2) | Pin 5, $V_{IN}^+$ = $V_{IN}^-$ = 0V, GND = 0V, GAIN = 20dB | 0 | | 180 | mV |
| First reference voltage | Vref (1) | Pin 2, Iref = 0 to 1mA | 2.6 | | 3.0 | V |
| Second reference voltage | Vref (2) | Pin 16, Iref =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 | VG | 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 $_{D9}$ = 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 |

## Package Dimensions

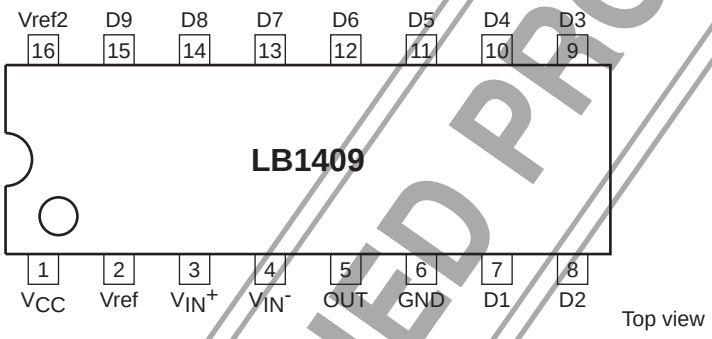
unit : mm (typ)

3006C

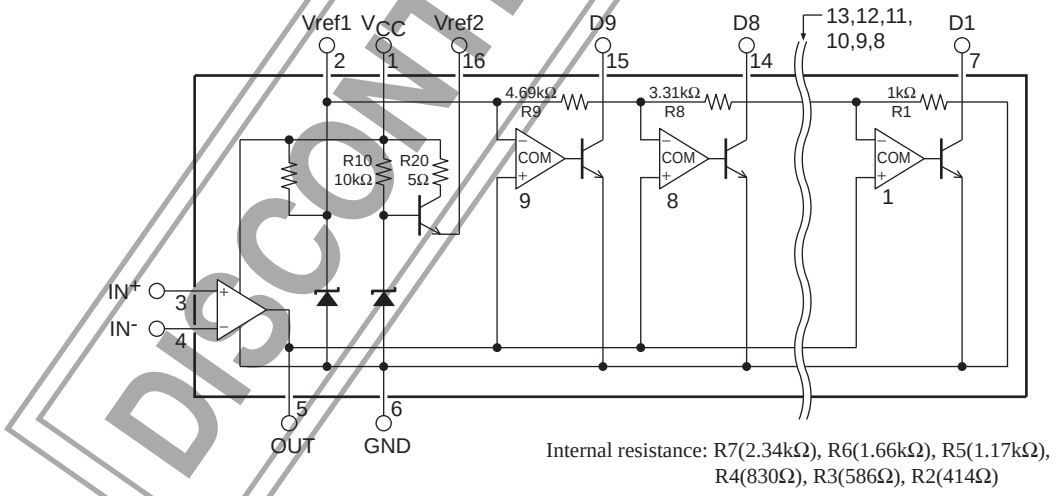



## Pin Assignment



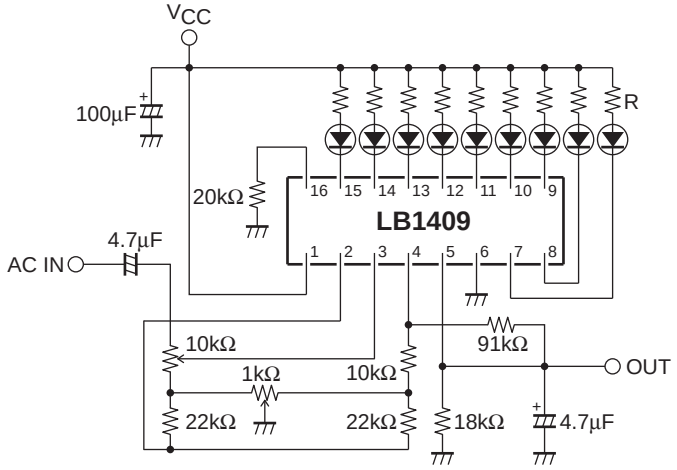

## Equivalent Circuit




Internal resistance: R7(2.34kΩ), R6(1.66kΩ), R5(1.17kΩ), R4(830Ω), R3(586Ω), R2(414Ω)

## 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√2mV from AC IN.
3. Adjust 1kΩ VR so that the output at OUT becomes 500 mV DC.

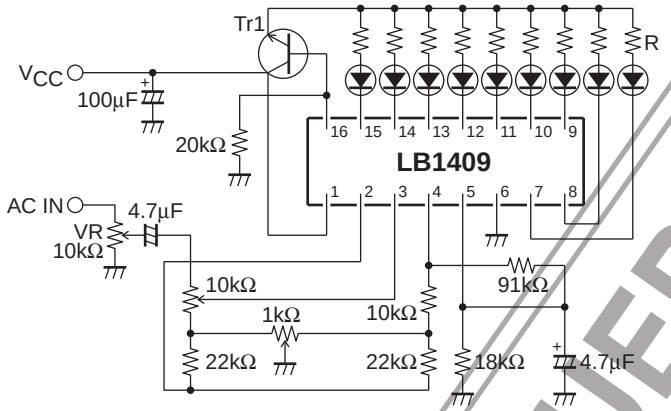
Equation used in the calculation of R to be inserted in series with LED.

Gain : 20dB

R (red) = ($V_{CC}$ - 2.5) / 6kΩ

R (green) = ($V_{CC}$ - 2.8) / 18kΩ

• Circuit using Vref 2




Adjusting procedures

• R to be inserted in series with LED is as follows irrespective of $V_{CC}$.

R (red) = 360Ω (Approx. 6 mA)

R (green) = 100Ω (Approx. 18 mA)

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

Red LED drive 2SD400

Green LED drive 2SD325





This catalog provides information as of June, 2007. Specifications and information herein are subject to change without notice.