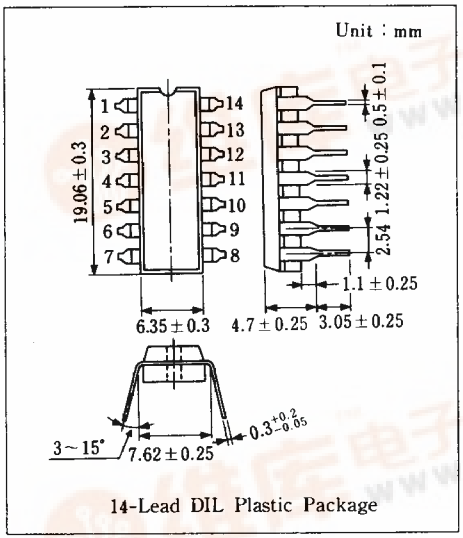
# AN6886

## 5-Dot LED Driver Circuit

### ■ Outline

The AN6886 is an integrated circuit designed for driving 5-dot LED and enables a logarithmic (dB) bar graph display.
Two gain-adjustable rectifier Amp. with external resistor are built in and adopt the large input priority system.
Because the output is the constant-current drawing system, the constant-current value can be varied by changing the external resistor.

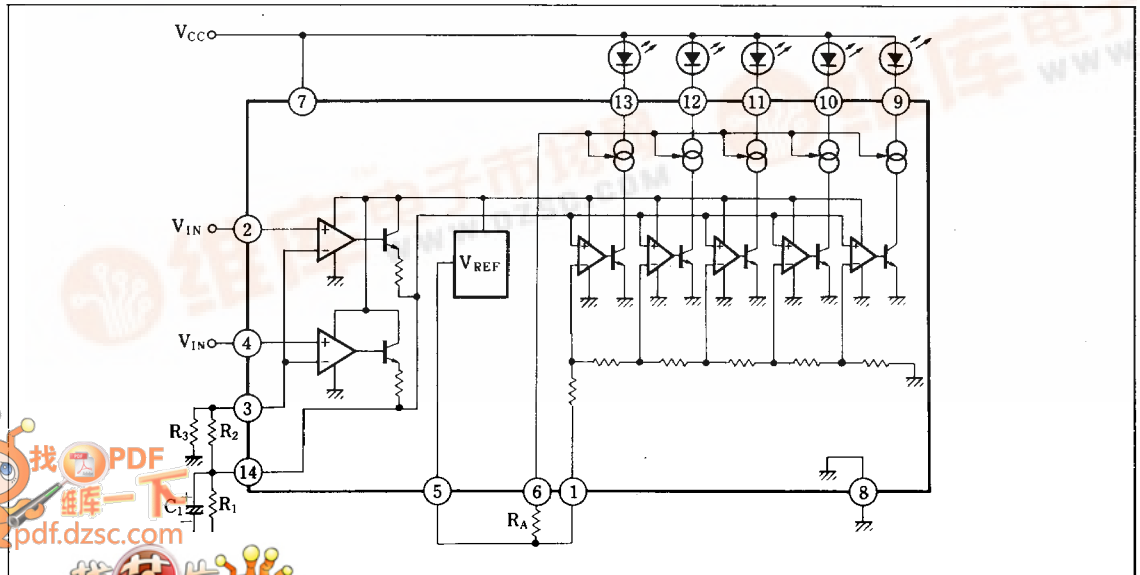


14-Lead DIL Plastic Package

### ■ Features

- Wide range of operating voltage : $V_{CC(opr.)}$ = 4~16V
- Wide range of fixed currents : 5~25mA
- Two built-in high-gain amplifiers
- Operation start voltage can be freely set.
  (When reference voltage is not used.)

### ■ Block Diagram



## ■ Pin

| Pin No. | Pin Name | Pin No. | Pin Name |
|---|---|---|---|
| 1 | LED ON Voltage Set Input | 8 | GND |
| 2 | Non Inverting Input(1) | 9 | LED1 Output |
| 3 | Inverting Input | 10 | LED2 Output |
| 4 | Non Inverting Input(2) | 11 | LED3 Output |
| 5 | Ref. Voltage | 12 | LED4 Output |
| 6 | LED Current Set Input | 13 | LED5 Output |
| 7 | $V_{CC}$ | 14 | Amp. Output |

## ■ Absolute Maximum Ratings (Ta=25℃)

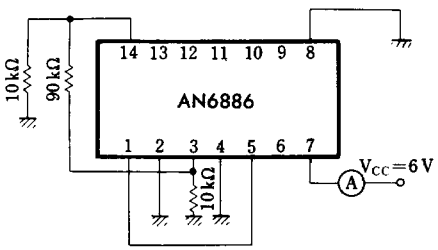
| Item | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Voltage | Supply Voltage | $V_{CC}$ | 18 | V |
| | Circuit Voltage | $V_{14-8}$ | 12 | V |
| | Operational Amp. Input Voltage | $V_{2,3,4-8}$ | −0.5 \| $V_{CC}$ | V |
| | LED-ON Set Voltage | $V_{1-8}$ | $V_{CC}$ | V |
| | LED Output Pin Voltage | $V_{9\sim13-8}$ | $V_{CC}$ | V |
| Current | Supply Current | $I_{CC}$ | 15 | mA |
| | LED Output Pin Current | $I_{9\sim13}$ | 30 | mA |
| | Reference Voltage Output Current | $I_5$ | −5 | mA |
| | RA Pin Input Current | $I_6$ | 10 | mA |
| Power Dissipation ($T_a \leqq 75℃$) | | $P_D$ | 480 | mW |
| Temperature | Operating Ambient Temperature | $T_{opr}$ | −30 ~ +75 | ℃ |
| | Storage Temperature | $T_{stg}$ | −55 ~ +150 | ℃ |

## ■ Electrical Characteristics (Ta=25℃, $V_{CC}$=6V)

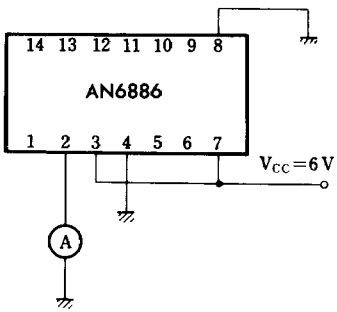
| Item | Symbol | Test Circuit | Condition | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| Current Consumption | $I_{tot}$ | 1 | $V_{2,4-8}$=0V, $R_A$=Open | | 4 | 8 | mA |
| Input Bias Current | $I_{Bias2}$ | 2 | | −1 | | 0 | μA |
| | $I_{Bias4}$ | 3 | | −1 | | 0 | μA |
| | $I_{Bias3}$ | 4 | | −2 | | 0 | μA |
| | $I_{Bias14}$ | 5 | | −5 | | 0 | μA |
| Output Offset Voltage | $V_{O(offset)}$ | 6 | $V_{2-8}$=30mV, $V_{4-8}$=0V, $G_V$=20dB | 200 | | 400 | mV |
| | $V_{O(offset)}$ | 6 | $V_{4-8}$=30mV, $V_{2-8}$=0V, $G_V$=20dB | 200 | | 400 | mV |
| Reference Voltage | $V_{REF}$ | 7 | | 2.6 | 2.8 | 3 | V |
| Output Sink Current | $I_{SINK9\sim13}$ | 8 | $R_A$=Open | 4 | | 9 | mA |
| | $I_{SINK9\sim13}$ | 9 | $R_A$=5.6kΩ | 11 | | 21 | mA |
| Voltage Gain | $G_{V1}$ | 10 | $V_{2-8}$=0.1V, $V_{4-8}$=0V | 19 | 20 | 21 | dB |
| | $G_{V2}$ | 11 | $V_{4-8}$=0.1V, $V_{2-8}$=0V | 19 | 20 | 21 | dB |
| Comparator Level | $GD_1$ | 8 | Pin ⑨ | −11 | −10 | −9 | dB |
| | $GD_2$ | 8 | Pin ⑩ $V_{1-8}$=2.8V | −5.5 | −5 | −4.5 | dB |
| | $GD_3$ | 8 | Pin ⑪ $V_{2-8}$=0V | −0.5 | 0 | 0.5 | dB |
| | $GD_4$ | 8 | Pin ⑫ $V_{4-8}$=0V | 2.5 | 3 | 3.5 | dB |
| | $GD_5$ | 8 | Pin ⑬ | 5 | 6 | 7 | dB |

ge : $V_{CC(op)}$=4 ~ 16V

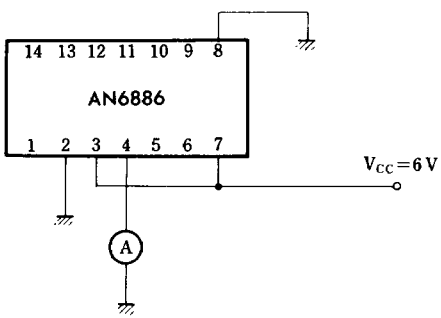
**Test Circuit 1** ($I_{tot}$)



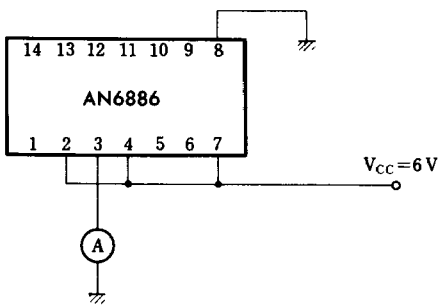

**Test Circuit 2** ($I_{Bias2}$)



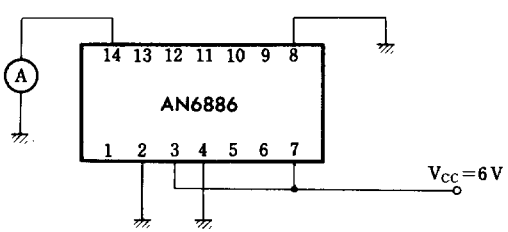

**Test Circuit 3** ($I_{Bias4}$)



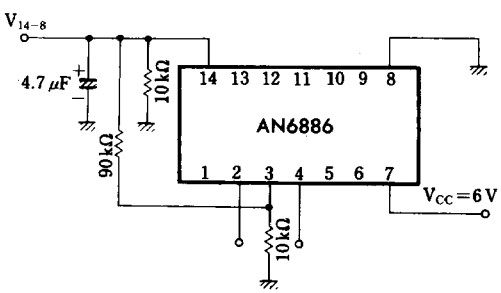

**Test Circuit 4** ($I_{Bias3}$)



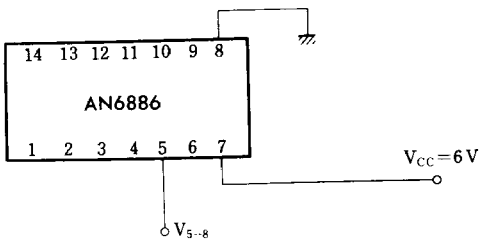

**Test Circuit 5** ($I_{Bias14}$)



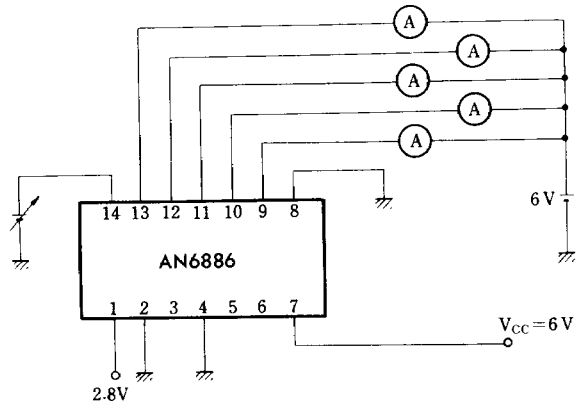

**Test Circuit 6** ($V_{O(offset)}$)



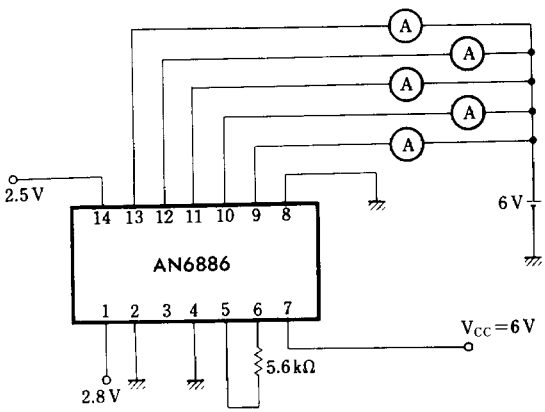
**Test Circuit 7** ($V_{REF.}$)



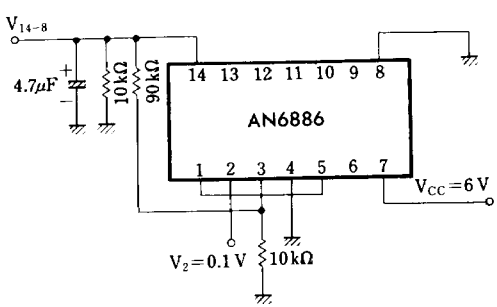

**Test Circuit 8** ($I_{(SINK)9-13}$, $GD_1$~$GD_5$)



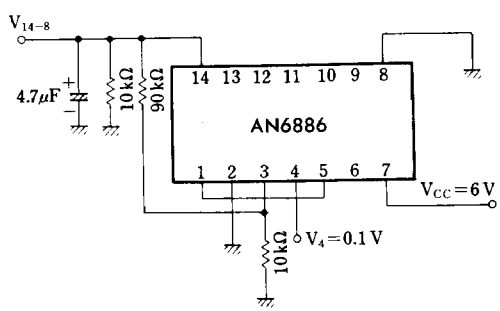

**Test Circuit 9** ($I_{(SINK)9-13}$)



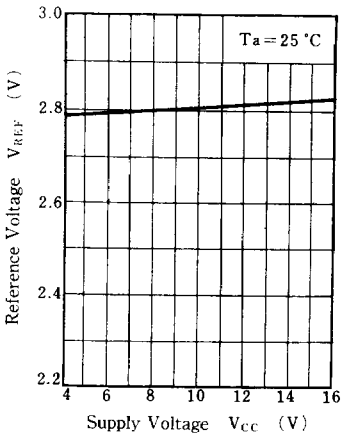

**Test Circuit 10** ($G_{V1}$)



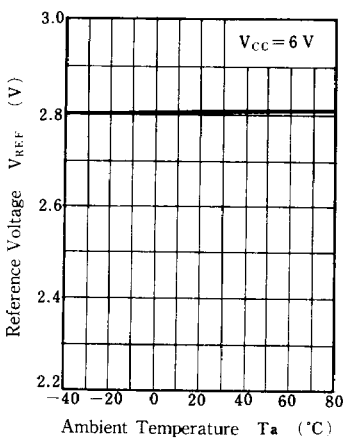

**Test Circuit 11** ($G_{V2}$)



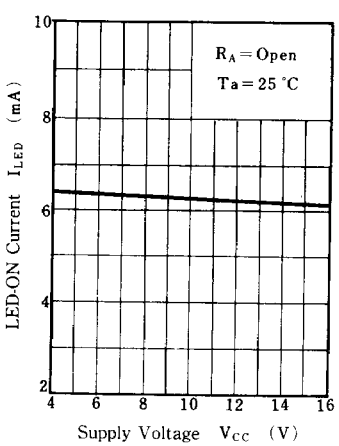
$V_{REF} - V_{CC}$



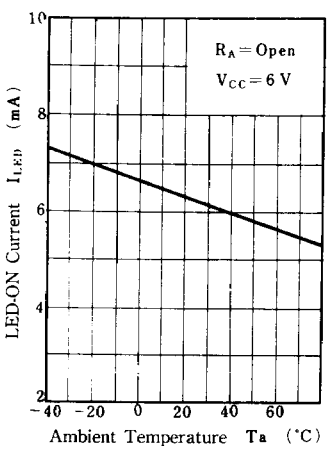

$V_{REF} - Ta$



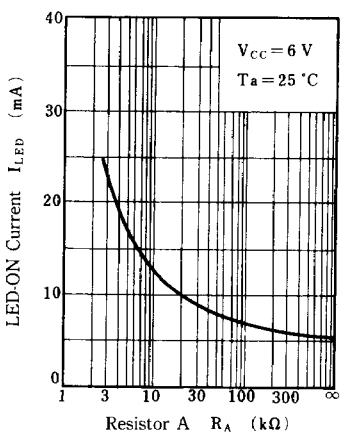

$I_{LED} - V_{CC}$



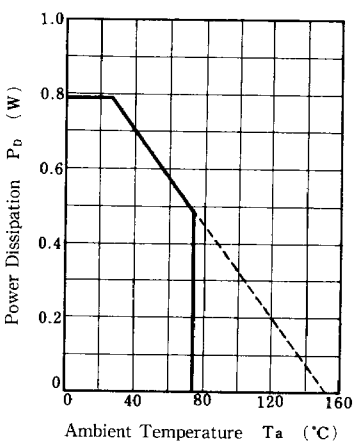

$I_{LED} - Ta$



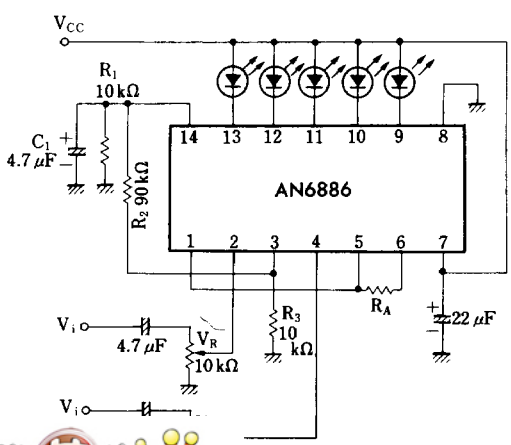

$I_{LED} - R_A$




$P_D - Ta$




## ■ Application Circuit




$$G_V = 20 \log \frac{R_2 + R_3}{R_3}$$

$R_2$, $R_3$: Resistors usd to determine a gain of input Amp.
$V_R$ : Resistor used to determine an input level
$C_1$, $R_1$: Used to determine a response time.
$R_A$ : Resistor used to determine an LED drive current.