

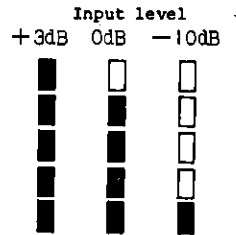
<b>SANYO</b>	No. 395F	<b>LB1405, 1415</b>
		<b>Level Meter</b>

**Use**

- . AC level meters such as VU meters.
- . DC level meters such as signal meters.
- . Supply voltage (battery, etc.) detection meters.

**Features**

- (1) 2 types of LB1405/1415 available depending on comparator.
- (2) Bar-shaped display of input level with 5 LEDs (see right.)
- (3) Built-in LED direct drive output of constant current that supply voltage regulation causes no variation of LED current.
- (4) Wide recommended supply voltage range : 4.4 to 12.0 V
- (5) Various uses enabled by built-in DC amplifier (30dB) : 4.4 to 12.0 V
- (6) Lighting/unlighting response time variable with an external resistor, capacitor.
- (7) No variation of display output owing to built-in constant voltage circuit even in case of supply voltage regulation.
- (8) High input impedance.



[Example of VU level meter]

Comparator Level at Ta=25°C, VCC=6V, Iref=5mA, See specified test circuit.

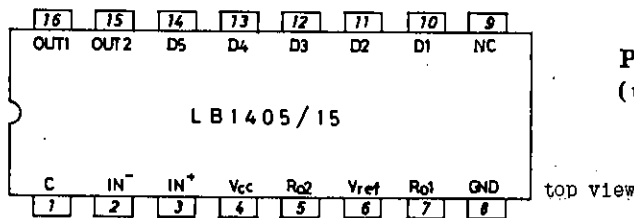
Comparator Level	Symbol	Pin No.	Conditions	LB1405			LB1415			unit
				min	typ	max	min	typ	max	
D5	GD5	Pin 14	VR02=2.6 to 3.0V, VR01=0V	1.6	2.0	2.4	5.5	6.0	6.5	dB
D4	GD4	Pin 13	VR02=2.6 to 3.0V, VR01=0V	-0.4	0	0.4	2.5	3.0	3.5	dB
D3	GD3	Pin 12	VR02=2.6 to 3.0V, VR01=0V	-3.6	-3.0	-2.4	-0.5	0	0.5	dB
D2	GD2	Pin 11	VR02=2.6 to 3.0V, VR01=0V	-8.0	-7.0	-6.0	-6.0	-5.0	-4.0	dB
D1	GD1	Pin 10	VR02=2.6 to 3.0V, VR01=0V	-17	-15	-13	-12	-10	-8	dB

[Definition of 0dB]

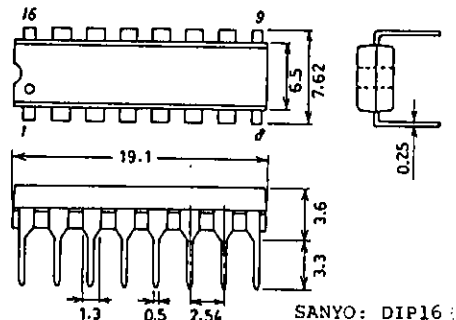
LB1405 2.37V at OUT2 is taken as 0 dB. (Voltage of R02:3V, voltage of R01:0V)

LB1415 1.50V at OUT2 is taken as 0 dB. (Voltage of R02:3V, voltage of R01:0V)

**Pin Assignment**



**Package Dimensions 3064-D16TR**  
(unit: mm)



## Absolute Maximum Ratings at Ta=25°C

Max. Supply Voltage	V <sub>CCmax</sub>	Pin 4	-0.3 to 14	V
Input Voltage	V <sub>IN</sub>	Pin 2, 3	-0.3 to 14	V
Terminal C Current	C <sub>I</sub>	Pin 1	-0.1 to 2.0	mA
Output Voltage	V <sub>OUT(1)</sub>	Pin 16	-0.3 to 12*	V
	V <sub>OUT(2)</sub>	Pin 15	-0.3 to 12	V
	V <sub>OUT</sub>	Pin 10 to 14	-0.3 to 14	V
Reference Current	I <sub>ref</sub>	Pin 6	0 to 10	mA
Allowable Power Dissipation	P <sub>dmax</sub>	Ta=55°C(whole package)		500 mW
Operating Temperature	T <sub>opr</sub>		-10 to +60	°C
Storage Temperature	T <sub>stg</sub>		-40 to +125	°C

\* Output terminal OUT1 is OFF and OUT2 is connected to pin 8 (GND) through 12kohms.

(Note) Do not apply more than (V<sub>CC</sub>+0.3V) to input and output pins.

(Be careful particularly when turning ON supply voltage.)

If no LED is connected to D1 to D5, connect these terminals to V<sub>CC</sub>.

## Operating Conditions at Ta=25°C

Supply Voltage	V <sub>CC</sub>	Pin 4	4.4 to 12	V
Reference Current	I <sub>ref</sub>	Pin 6	2.5 to 9	mA
Output 2 Load Resistance	R <sub>L2</sub>	Pin 15	15 to 20	kohm(Insert between OUT2 and GND.)

Electrical Characteristics at Ta=25°C, V<sub>CC</sub>=4.4 to 12V, See specified test circuit.

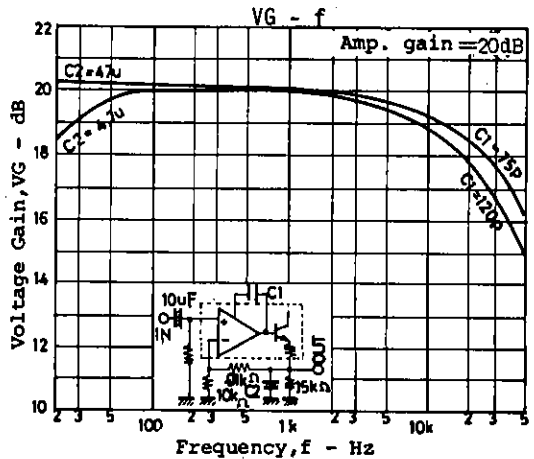
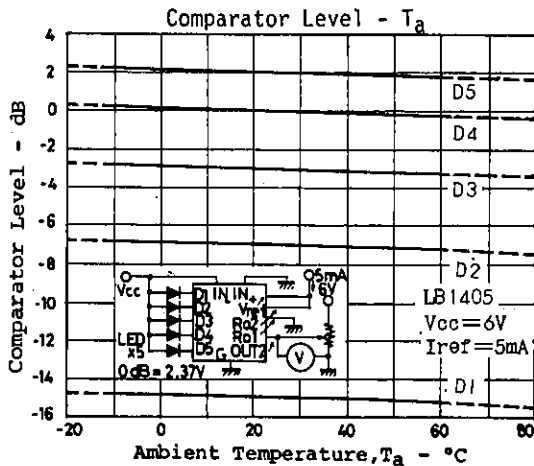
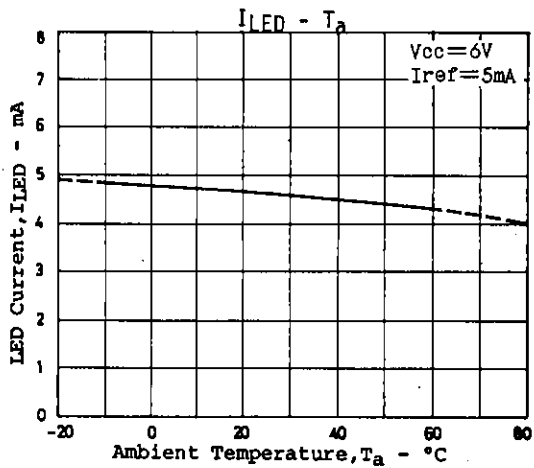
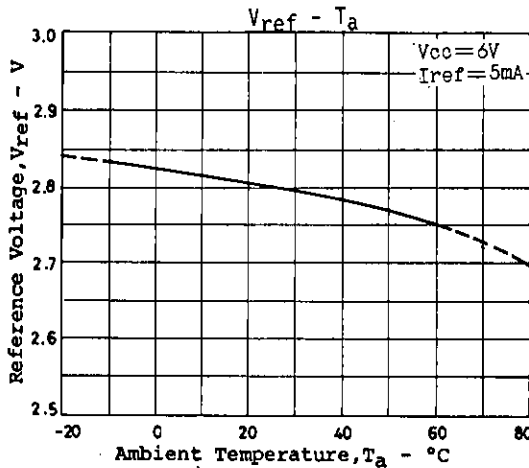
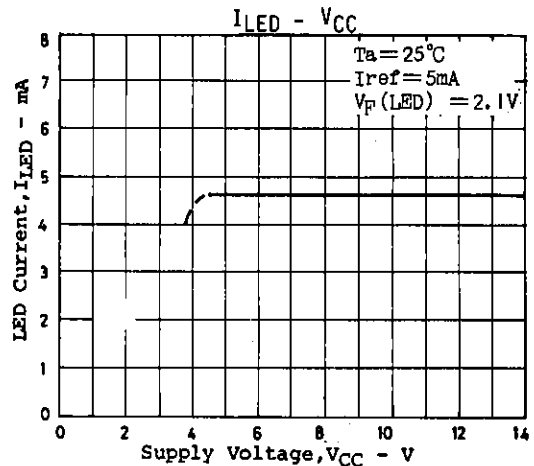
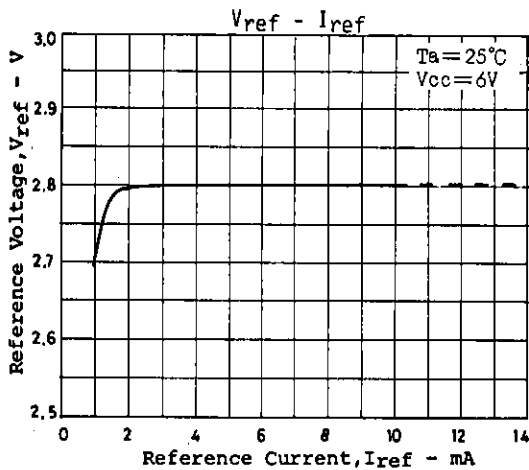
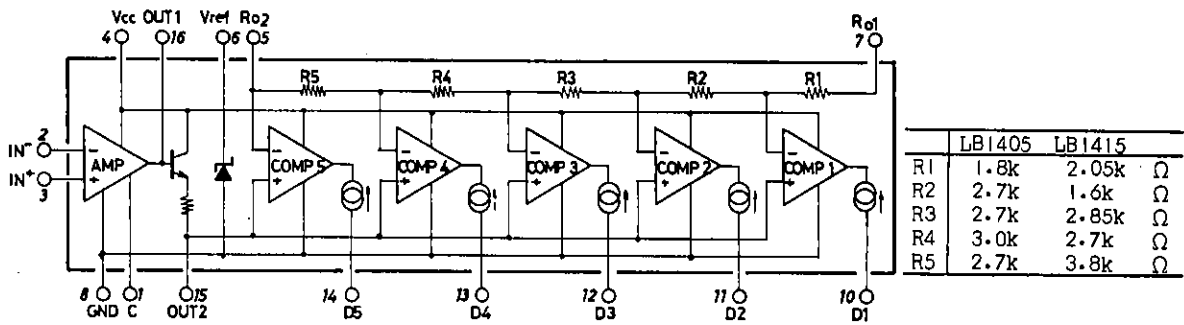
				min	typ	max	unit
Input Bias Current (Amplifier)	I <sub>IN+</sub> (A)	Pin 2	V <sub>CC</sub> =12V, V <sub>IN+</sub> =-10V, V <sub>IN-</sub> =0V, I <sub>ref</sub> =5mA	-2		0	μA
	I <sub>IN-</sub> (A)	Pin 3	V <sub>CC</sub> =12V, V <sub>IN+</sub> =0V, V <sub>IN-</sub> =-10V, I <sub>ref</sub> =5mA	-2		0	μA
Input Bias Current (Comparator)	I <sub>IN+</sub> (C)	Pin 5,7	V <sub>CC</sub> =12V, V <sub>IN+</sub> =10V, V <sub>IN-</sub> =0V, V <sub>R01</sub> =0V, V <sub>R02</sub> =0V, I <sub>ref</sub> =5mA	-10		0	μA
	I <sub>IN-</sub> (C)	Pin 15	V <sub>CC</sub> =12V, V <sub>IN+</sub> =0V, V <sub>IN-</sub> =-10V, V <sub>R01</sub> =V <sub>R02</sub> =V <sub>ref</sub> , I <sub>ref</sub> =5mA, V <sub>OUT2</sub> =0V	-10		0	μA
Reference Voltage	V <sub>ref</sub>	Pin 6	I <sub>ref</sub> =2.5 to 9.0mA	2.6		3.0	V
Amp Offset Voltage (Amplifier)	V <sub>offset</sub>	Pin 15	I <sub>ref</sub> =5mA, Amp gain=20dB	-500		+500	mV
Output Flow-in Current OUT1	I <sub>OL</sub> (1)	Pin 16	V <sub>OUT1</sub> =0.5V, V <sub>IN+</sub> =0V, V <sub>IN-</sub> =4V, I <sub>ref</sub> =5mA	0.2			mA
Output Flow-out Current OUT1	I <sub>OH</sub> (1)	Pin 16	V <sub>OUT1</sub> =3.7V, V <sub>IN+</sub> =4V, V <sub>IN-</sub> =0V, I <sub>ref</sub> =5mA			-20	μA
Output Flow-out Current OUT2	I <sub>OH</sub> (2)	Pin 15	V <sub>CC</sub> =4.4V, V <sub>OUT2</sub> =0V, I <sub>ref</sub> =5mA			-3.1	mA
	I <sub>OH</sub> (2)	Pin 15	V <sub>CC</sub> =12V, V <sub>OUT2</sub> =0V, I <sub>ref</sub> =5mA			-7.0	mA
Output Flow-in Current D1 to D5	I <sub>OL</sub> (D)	Pin10 to14	V <sub>CC</sub> =4.4V, V <sub>D1 to 5</sub> =2.3V, V <sub>IN-</sub> =0V, I <sub>ref</sub> =5mA, V <sub>IN+</sub> =3V, V <sub>R02</sub> =3V	3		7.5	mA
	I <sub>OL</sub> (D)	Pin10 to14	V <sub>CC</sub> =12V, V <sub>D1 to 5</sub> =9.7V, V <sub>IN-</sub> =0V, I <sub>ref</sub> =5mA, V <sub>IN+</sub> =9V, V <sub>R02</sub> =9V	3		7.5	mA
Output Leak Current D1 to D5	I <sub>OH</sub> (D)	Pin10 to14	V <sub>CC</sub> =12V, V <sub>IN+</sub> =0V, I <sub>ref</sub> =5mA, V <sub>IN-</sub> =9V, V <sub>R02</sub> =9V			50	μA
Current Dissipation	I <sub>CC</sub>	Pin 4	V <sub>CC</sub> =12V, V <sub>IN+</sub> =0V, V <sub>IN-</sub> =-10V, I <sub>ref</sub> =5mA	8		15	mA
Amp Gain	V <sub>G</sub>	Open loop		30			dB

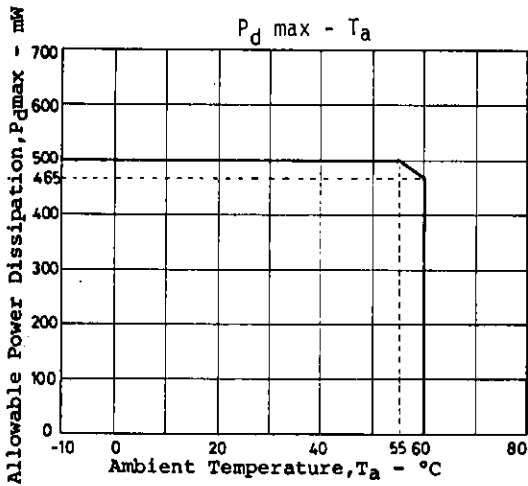
(Note) Direction of current

Plus (no sign): Flowing into IC

Minus (-): Flowing out of IC

Equivalent Circuit Block Diagram





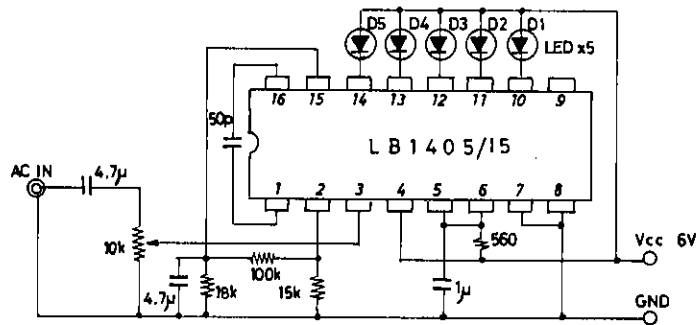
Proper cares in using the IC

- If D output is not used, connect it to  $V_{CC}$ .
- Apply current to  $V_{ref}$  whose voltage is used inside the IC.

Sample Application Circuits

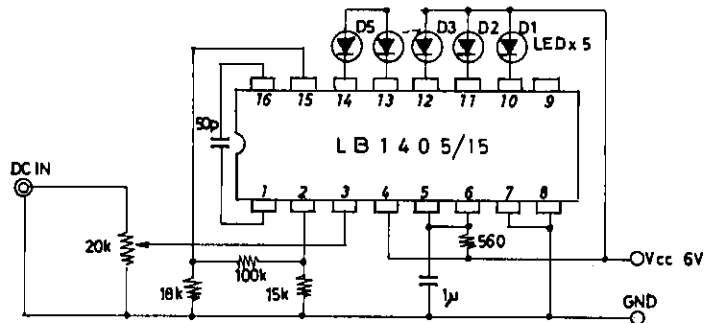
Unit (resistance:  $\Omega$ , capacitance: F)

1. VU meter

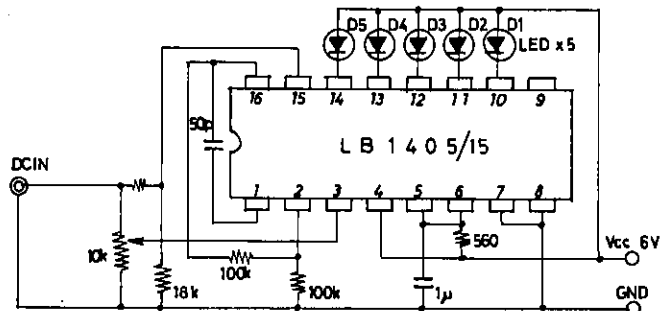


• Adjust 0dB point with the semifixed resistor of input.  
(The same applies in the following cases.)

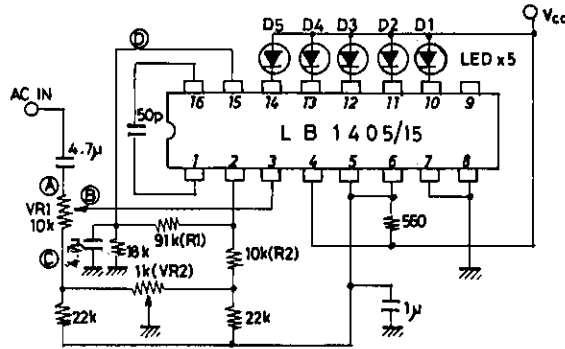
2. Signal meter



3. Zero point shift (battery voltage checker)

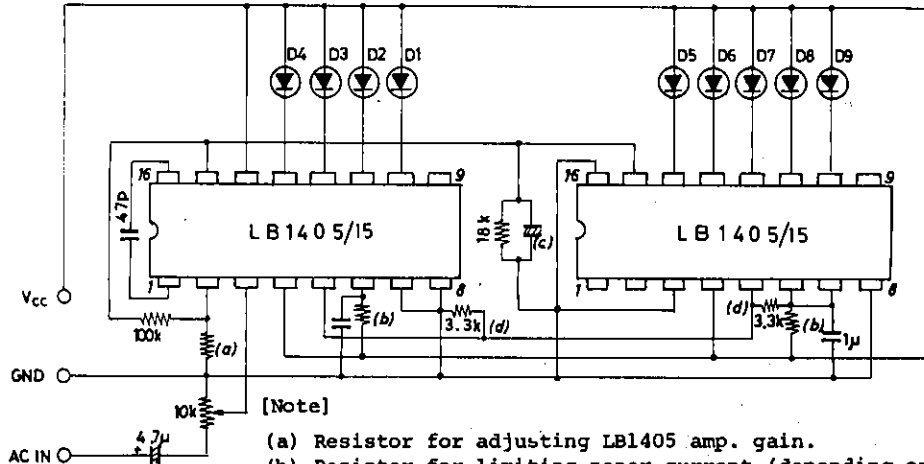


4. Offset adjust circuit (VU meter)



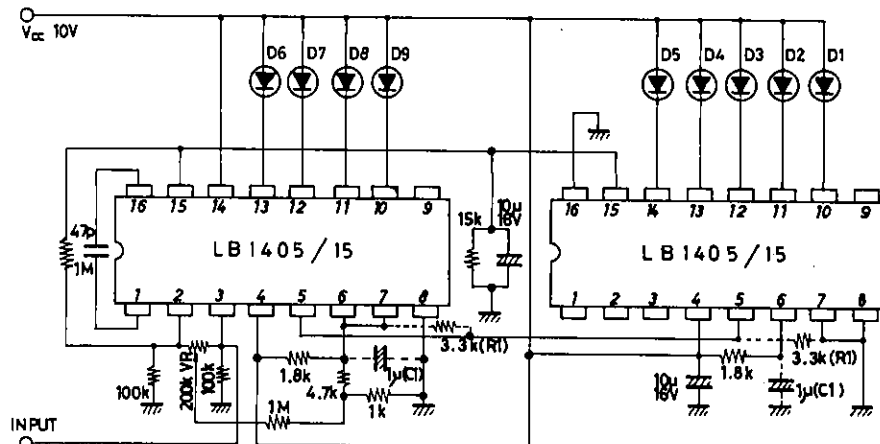
- Adjusting procedure
1. Set VR1 to ①.
  2. Make AC IN quiescent.
  3. Apply DC 50mV across pins ② and ③.
  4. Adjust VR2 so that voltage on pin ④ becomes 500mV.
  5. Remove voltage applied across pin ② and ③.
- Note: Voltage on pin ④ is  $500\text{mV} \times \frac{R1+R2}{R2}$ .

5. Display of 9 LEDs (1)



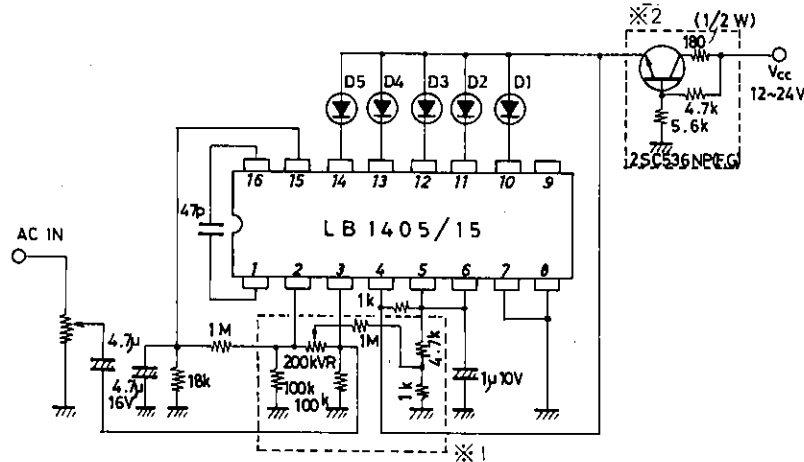
- [Note]
- (a) Resistor for adjusting LB1405 amp. gain.
  - (b) Resistor for limiting zener current (depending on Vcc).
  - (c) Capacitor (1 to 100 µF) for adjusting response time.
  - (d) For adjusting variation of comparator level between 2 ICs.

6. Display of 9 LEDs (2)



- Note VR: For adjusting offset voltage  
 C1: Desirable to use for preventing oscillation of Vref.  
 R1: Desirable to use for adjusting variation of comparator level between 2 ICs.

7. VU meter used at  $V_{CC}=12$  to  $24$  V

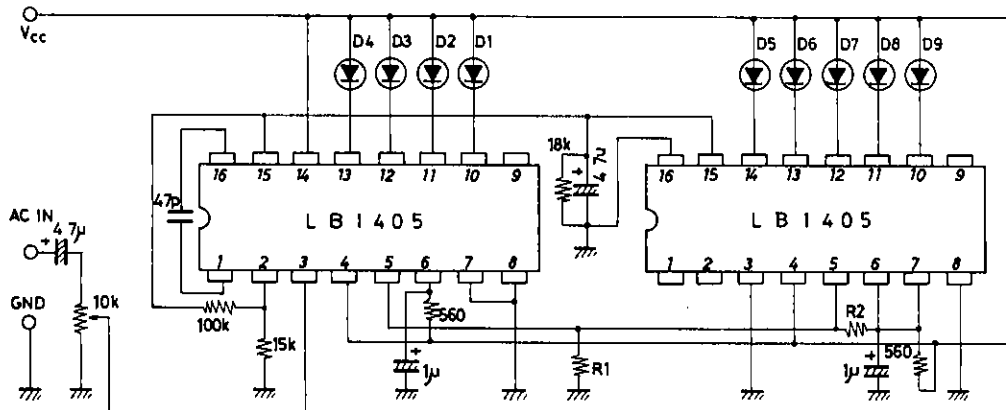


- ※1 Offset adjust circuit of input amp.
- ※2 Circuit for dropping supply voltage applied to IC.

8. Cascade connection

This is an example of cascade connection where external resistors are used between  $R_{O1}$  and  $R_{O2}$ . The comparator level is mainly described. For offset adjust circuit of input amp, refer to 4 or 7.

. 2-pc. cascade connection



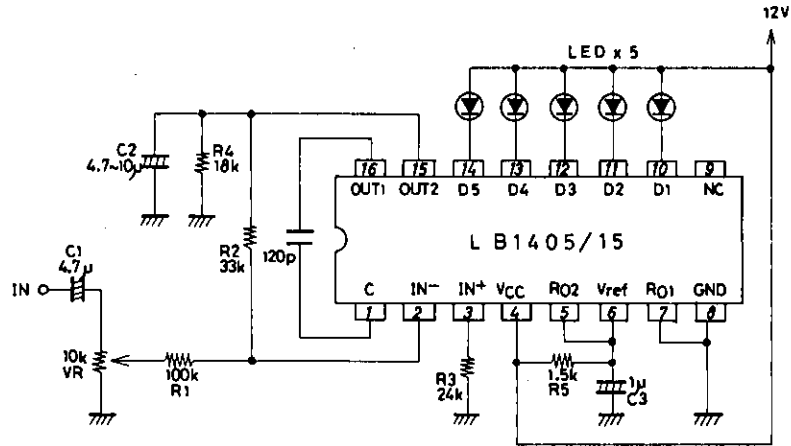
- 1) Comparator level at  $R_1=R_2=3.3k$  (Error of resistance ratio of  $R_1$ ,  $R_2$  is desirable to be less than 1%.)

LED No.	D1	D2	D3	D4	D5	D6	D7	D8	D9
dB (typ.)	-19	-11	-6.5	-3.7	-1.6	0	+1.5	+2.7	+3.7

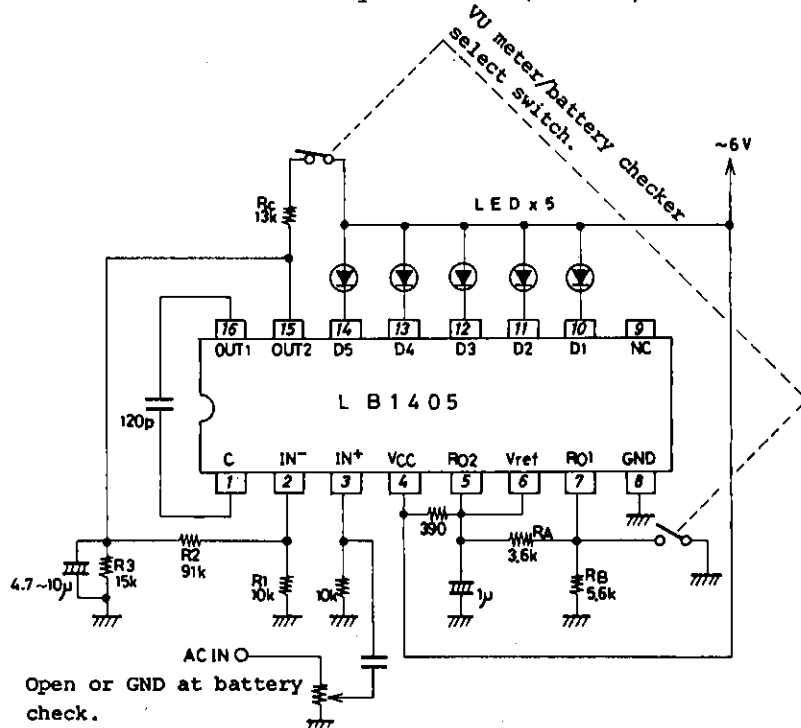
- 2) Comparator level at  $R_1=3k, R_2=2k$  (Error of resistance ratio of  $R_1$ ,  $R_2$  is desirable to be less than 1%.)

LED No.	D1	D2	D3	D4	D5	D6	D7	D8	D9
dB (typ.)	-18	-10	-6.5	-3	-1.2	0	+1	+2	+3

9. Circuit where speaker output of audio amp is input  
 Full scale at 7 V<sub>rms</sub> input



10. Circuit for both VU meter and battery checker (6V set)



Operation at battery check (Error of R<sub>A</sub>, R<sub>B</sub> is 5% considering variation of IC.)

Lighting-on Level	Battery voltage			unit
	min	typ	max	
D <sub>1</sub> lighted	3.5	4.0	4.5	V
D <sub>2</sub> lighted	3.9	4.4	4.9	V
D <sub>3</sub> lighted	4.3	4.8	5.3	v
D <sub>4</sub> lighted	4.7	5.2	5.7	V
D <sub>5</sub> lighted	5.1	5.6	6.1	V

If R<sub>C</sub>, R<sub>B</sub> are adjusted as semifixed resistor, error will be further reduced.

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