

Ordering number: EN 395F

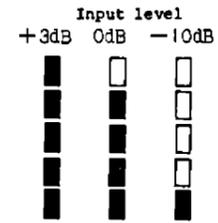
SANYO	No. 395F	Monolithic Digital IC
	LB1405, 1415	
Level Meter		

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.

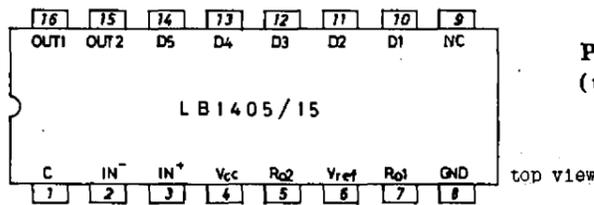
Comparator	Level Symbol	Pin No.	Conditions	LB1405			LB1415			unit
				min	typ	max	min	typ	max	
D5	GD5	Pin 14	VR02=2.6 to 3.0V, VR01=0V	1.6	2.0	2.4	5.5	6.0	6.5	dB
D4	GD4	Pin 13	VR02=2.6 to 3.0V, VR01=0V	-0.4	0	0.4	2.5	3.0	3.5	dB
D3	GD3	Pin 12	VR02=2.6 to 3.0V, VR01=0V	-3.6	-3.0	-2.4	-0.5	0	0.5	dB
D2	GD2	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]

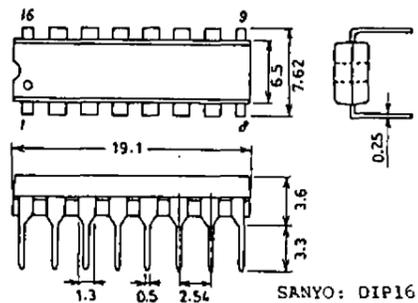
LB1405 2.37V at OUT2 is taken as 0 dB. (Voltage of R02:3V, voltage of R01:0V)

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)



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8217KI/8065MW/1161KI No.395-1/8

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Absolute Maximum Ratings at Ta=25°C

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

Operating Conditions at Ta=25°C

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

Electrical Characteristics at Ta=25°C, V_{CC}=4.4 to 12V, See specified test circuit.

				min	typ	max	unit
Input Bias Current (Amplifier)	I _{IN+} (A)	Pin 2	V _{CC} =12V, V _{IN+} =-10V, V _{IN-} =0V, I _{ref} =5mA	-2	0	0	µA
	I _{IN-} (A)	Pin 3	V _{CC} =12V, V _{IN+} =0V, V _{IN-} =-10V, I _{ref} =5mA	-2	0	0	µA
Input Bias Current (Comparator)	I _{IN+} (C)	Pin 5, 7	V _{CC} =12V, V _{IN+} =10V, V _{IN-} =0V, V _{R01} =0V, V _{R02} =0V, I _{ref} =5mA	-10	0	0	µA
	I _{IN-} (C)	Pin 15	V _{CC} =12V, V _{IN+} =0V, V _{IN-} =-10V, V _{R01} =V _{R02} =V _{ref} , I _{ref} =5mA, V _{OUT2} =0V	-10	0	0	µA
Reference Voltage	V _{ref}	Pin 6	I _{ref} =2.5 to 9.0mA	2.6	3.0		V
Amp Offset Voltage (Amplifier)	V _{offset}	Pin 15	I _{ref} =5mA, Amp gain=20dB	-500		+500	mV
Output Flow-in Current OUT1	I _{OL} (1)	Pin 16	V _{OUT1} =0.5V, V _{IN+} =0V, V _{IN-} =4V, I _{ref} =5mA	0.2			mA
Output Flow-out Current OUT1	I _{OH} (1)	Pin 16	V _{OUT1} =3.7V, V _{IN+} =4V, V _{IN-} =0V, I _{ref} =5mA			-20	µA
Output Flow-out Current OUT2	I _{OH} (2)	Pin 15	V _{CC} =4.4V, V _{OUT2} =0V, I _{ref} =5mA			-3.1	mA
	I _{OH} (2)	Pin 15	V _{CC} =12V, V _{OUT2} =0V, I _{ref} =5mA			-7.0	mA
Output Flow-in Current D1 to D5	I _{OL} (D)	Pin10 to 14	V _{CC} =4.4V, V _{D1 to 5} =2.3V, V _{IN-} =0V, I _{ref} =5mA, V _{IN+} =3V, V _{R02} =3V	3		7.5	mA
	I _{OL} (D)	Pin10 to 14	V _{CC} =12V, V _{D1 to 5} =9.7V, V _{IN-} =0V, I _{ref} =5mA, V _{IN+} =9V, V _{R02} =9V	3		7.5	mA
Output Leak Current D1 to D5	I _{OH} (D)	Pin10 to 14	V _{CC} =12V, V _{IN+} =0V, I _{ref} =5mA, V _{IN-} =9V, V _{R02} =9V			50	µA
Current Dissipation	I _{CC}	Pin 4	V _{CC} =12V, V _{IN+} =0V, V _{IN-} =-10V, I _{ref} =5mA	8	15		mA
Amp Gain	V _G	Open loop		30			dB

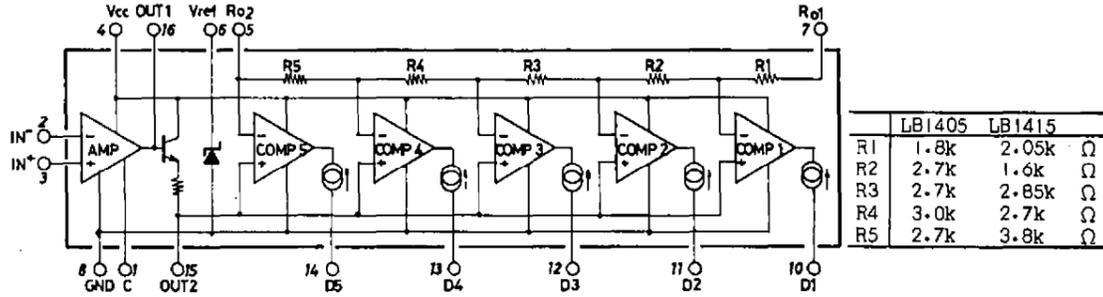
(Note) Direction of current

Plus (no sign): Flowing into IC

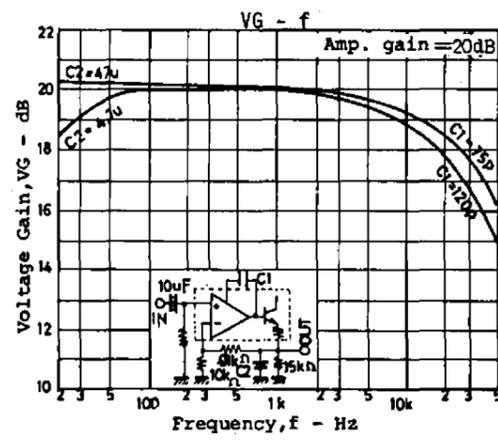
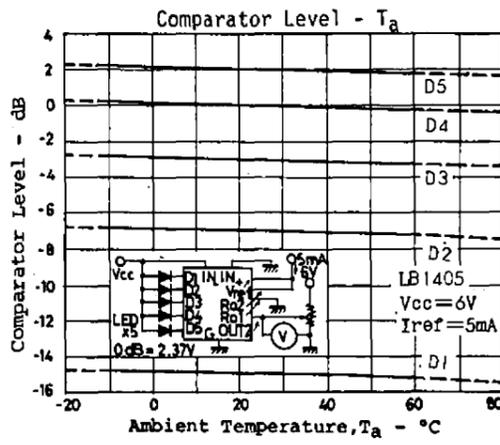
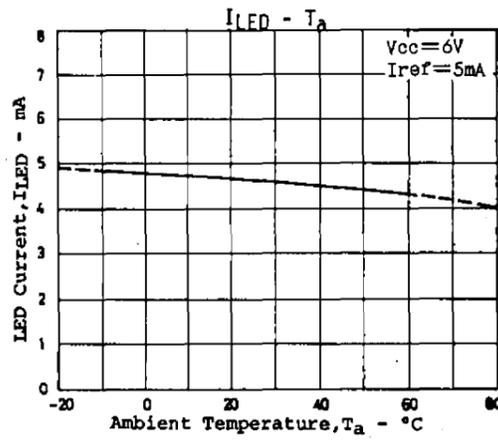
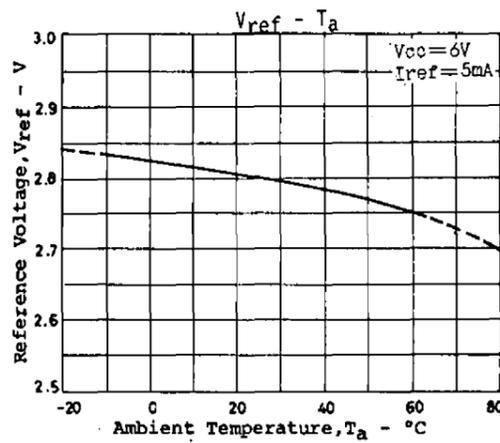
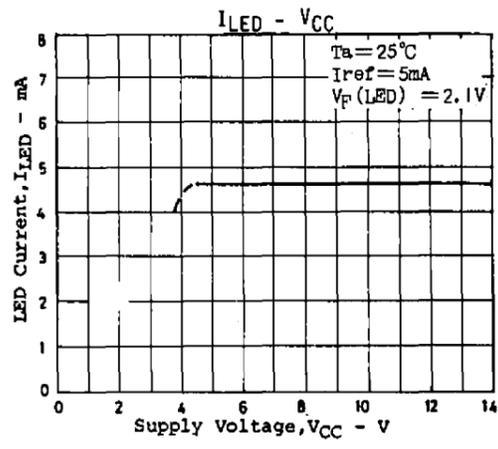
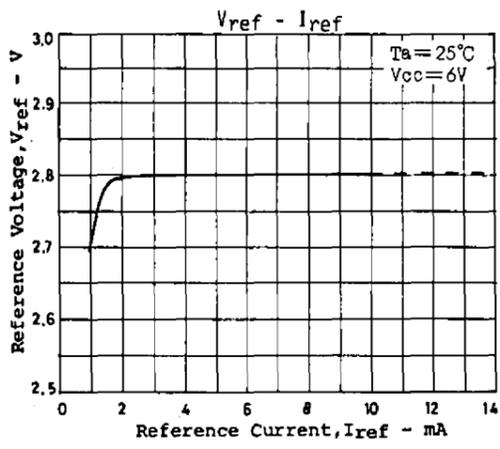
Minus (-): Flowing out of IC

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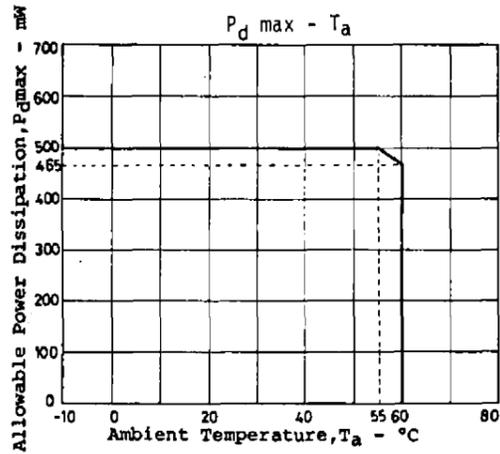
Equivalent Circuit Block Diagram



	LB1405	LB1415	
R1	1.8k	2.05k	Ω
R2	2.7k	1.6k	Ω
R3	2.7k	2.85k	Ω
R4	3.0k	2.7k	Ω
R5	2.7k	3.8k	Ω



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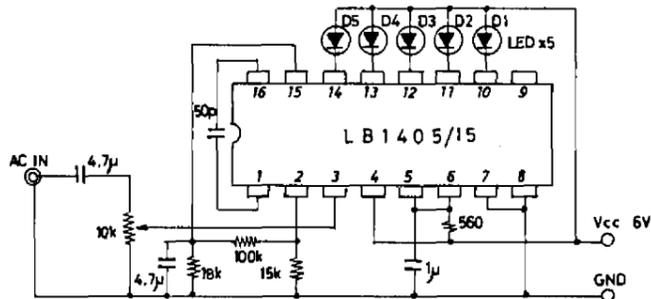


- Proper cares in using the IC
- . If D output is not used, connect it to V_{CC} .
 - . Apply current to V_{ref} whose voltage is used inside the IC.

Sample Application Circuits

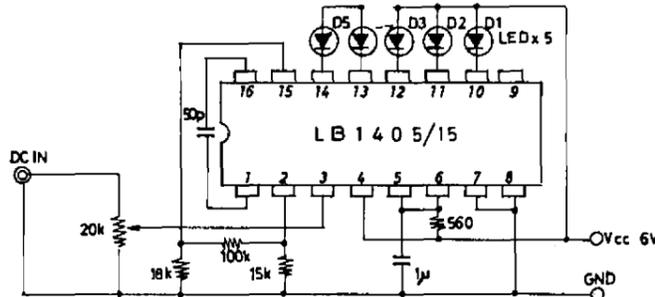
Unit (resistance: Ω , capacitance: F)

1. VU meter

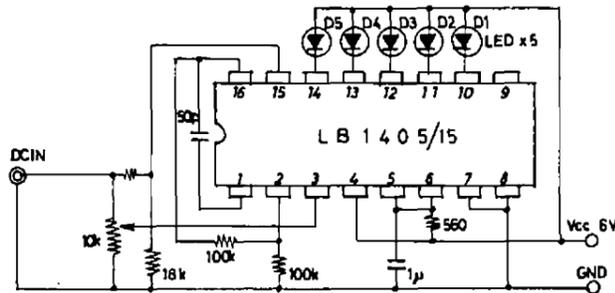


. Adjust 0dB point with the semifixed resistor of input.
(The same applies in the following cases.)

2. Signal meter



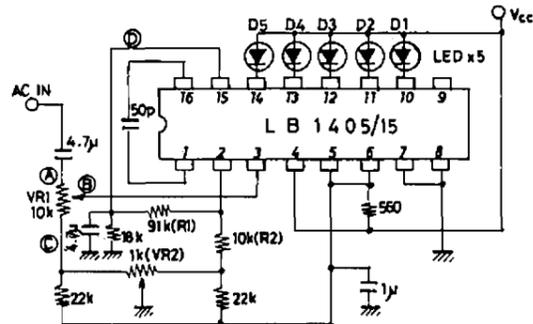
3. Zero point shift (battery voltage checker)



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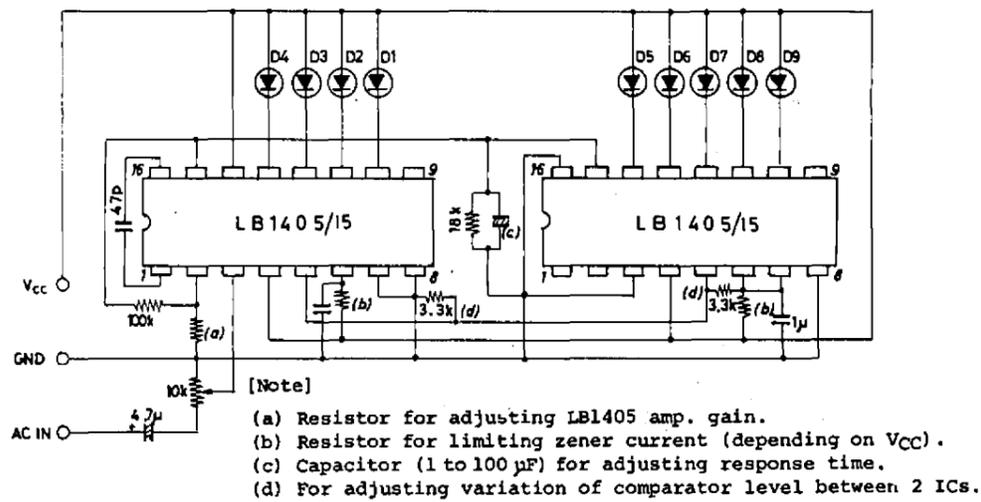
Unit (resistance: Ω, capacitance: F)

4. Offset adjust circuit (VU meter)

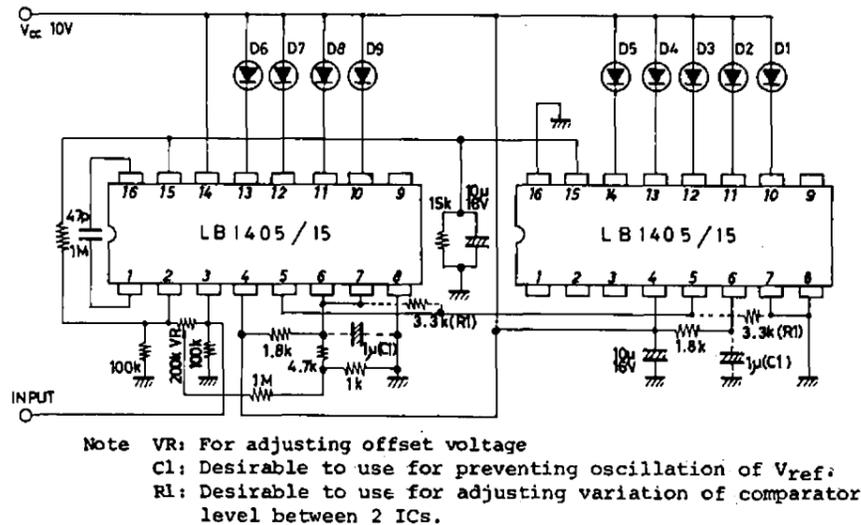


- Adjusting procedure
1. Set VR1 to ①.
 2. Make AC IN quiescent.
 3. Apply DC 50mV across pins ② and ③.
 4. Adjust VR2 so that voltage on pin ④ becomes 500mV.
 5. Remove voltage applied across pin ② and ③.
- Note: Voltage on pin ④ is $500mV \times \frac{R1+R2}{R2}$.

5. Display of 9 LEDs (1)



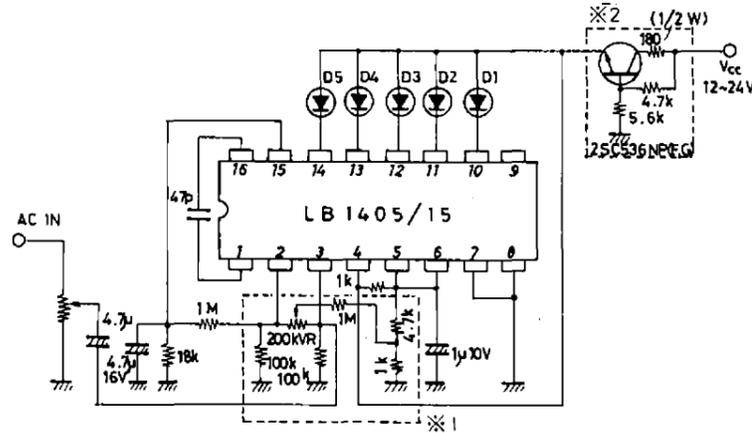
6. Display of 9 LEDs (2)



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Unit (resistance: Ω , capacitance: F)

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



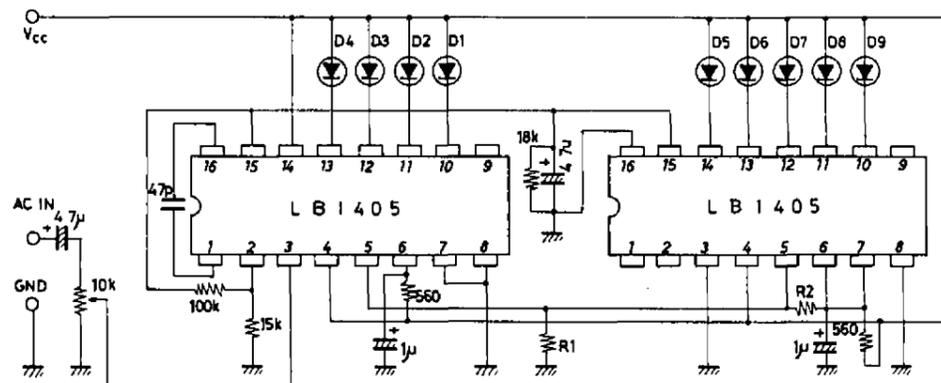
- ※1 Offset adjust circuit of input amp.
- ※2 Circuit for dropping supply voltage applied to IC.

8. Cascade connection

This is an example of cascade connection where external resistors are used between R_{01} and R_{02} .

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

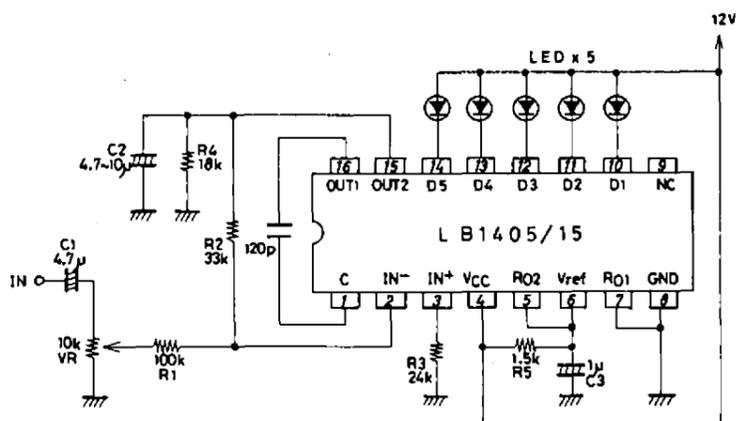
- 2) Comparator level at $R_1=3k, R_2=2k$ (Error of resistance ratio of R_1 , R_2 is desirable to be less than 1%.)

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

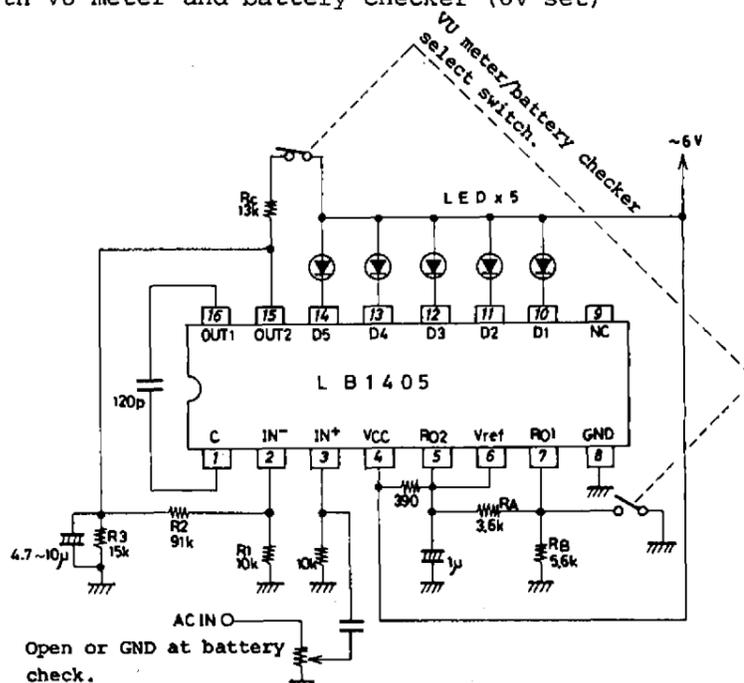
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Unit (resistance: Ω, capacitance: F)

9. Circuit where speaker output of audio amp is input
 .Full scale at 7 V_{rms} input



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



Operation at battery check (Error of R_A, R_B is 5% considering variation of IC.)

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

If R_C, R_B are adjusted as semifixed resistor, error will be further reduced.

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