

1

3

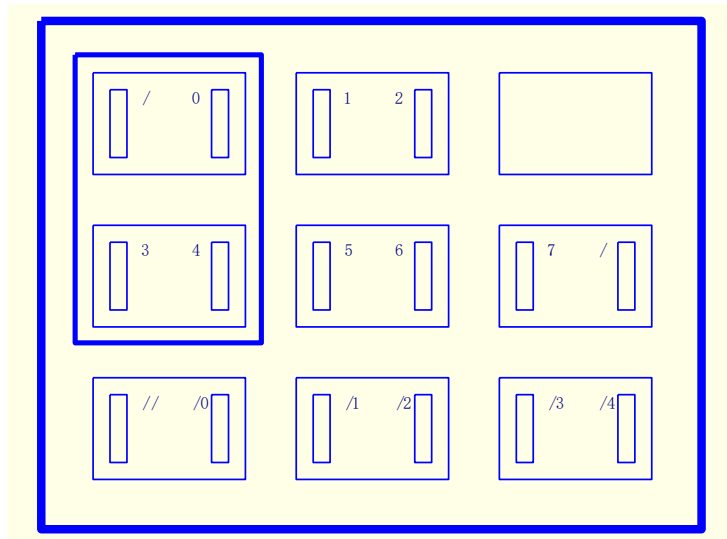
9

LM311

12

ICL8038

15



A/D D/A

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位

U/F

F/U

JP11 JP12 JP13 JP14 JP15

220V

220V

±5V ±12V ±15V 0 30V

ON

OFF

220V

1

2

3

4

5

6

7

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1 A_{ud} $CMRR$ U_{os} U_{oppm} I_{os} GW

2

3

4

1

2

3

4

1 U_{os} mV U_{os}

8-DIP

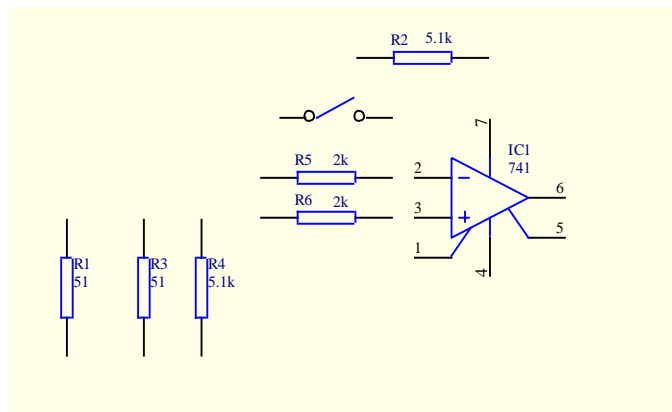
TO-99

2 3 6 7 4

8 1 5 1 5 5

1 5

1-1



1-1

S1 S2

U_{O1}

$$A_{uf} = \frac{U_{O1}}{U_{OS}} = \frac{R_1 + R_2}{R_1}$$

$$U_{OS} = \frac{R_1}{R_1 + R_2} \cdot U_{O1} = \frac{1}{101} \cdot U_{O1} \quad 1-1$$

$$U_{OS} \quad \pm 1 \quad 20 \quad \text{mV} \quad U_{OS} \quad 1\text{mV}$$

2 I_{OS}

$$I_{OS} = |I_{B+} - I_{B-}|$$

$$I_{OS}$$

$$1-1 \quad I_{OS} \quad S1 \quad S2 \quad U_{O1'}$$

$$I_{OS} = \frac{U_{O1'} - U_{O1}}{A_{uf} \cdot R_5} = \frac{R_1}{R_1 + R_2} \cdot \frac{U_{O1'} - U_{O1}}{R_5} \quad 1-2$$

$$I_{OS} \quad 1\text{nA}$$

3 A_{ud}

$$\Delta U_o$$

$$\Delta U_{id}$$

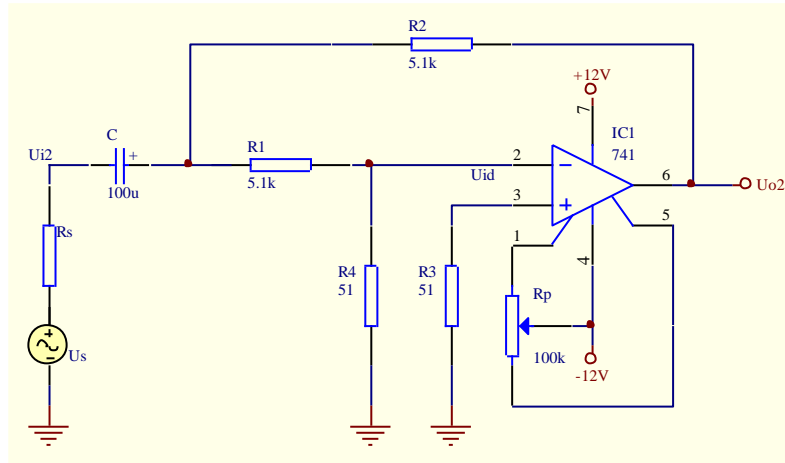
$$A_{ud} = \frac{\Delta U_o}{\Delta U_{id}}$$

dB

$$A_{ud}(\text{dB}) = 20 \lg \left(\frac{\Delta U_o}{\Delta U_{id}} \right) \quad (\text{dB})$$

Hz

1-2



$$A_{ud} = \frac{R_2}{R_1} \cdot \frac{R_1 + R_4}{R_4} \cdot \frac{R_s}{C} \quad (1-2)$$

$$A_{ud}(\text{dB}) = 20 \lg \left(\frac{\Delta U_{o2}}{\Delta U_{id}} \right) = 20 \lg \left[\left(1 + \frac{R_1}{R_4} \right) \cdot \frac{U_{O2}}{U_{i2}} \right] \cdot (\text{dB}) \quad (1-3)$$

100dB
4

CMRR

A_{ud}

A_{uc}

$$CMRR = \frac{A_{ud}}{A_{uc}}$$

dB $CMRR$

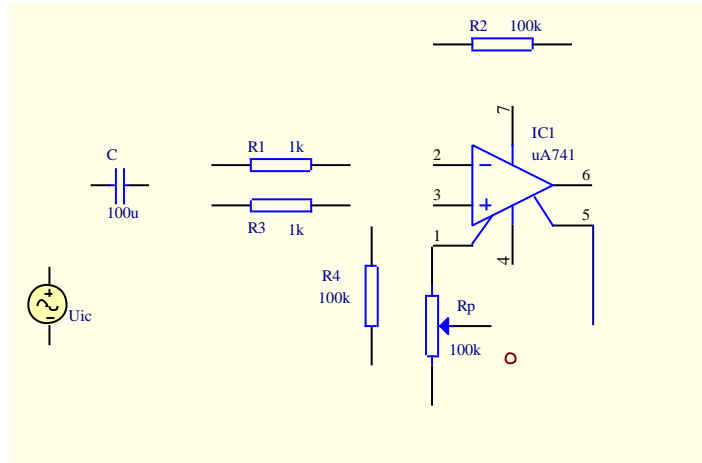
$$CMRR = 20 \lg \left(\frac{A_{ud}}{A_{uc}} \right) (\text{dB})$$

$CMRR$

$CMRR$

1-3

$CMRR$



1-3 CMRR

$$|A_{ud}| = \frac{R_2}{R_1}$$

$$|A_{uc}| = \frac{U_{oc}}{U_{ic}}$$

CMRR

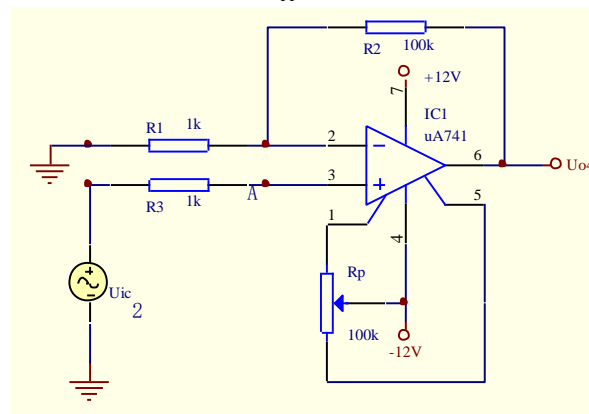
$$CMRR = 20 \lg \left(\frac{R_2 U_{ic}}{R_1 U_{oc}} \right) \text{ (dB)}$$

1-4

5

U_{oc} U_{ic} $CMRR$ $CMRR$ 80dB
 U_{oppm}
 U_{oppm} 仪
 10V

1-4



1-4

U_{oppm}

6

GW
 GW
 0.707

1

$$GW = A_{ud} f$$

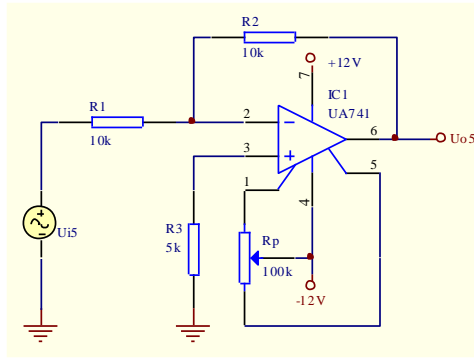
1-5

GW

100~200mV

1-5

GW



1-5

GW

| | | | | | | |
|----------|-----------|-------------|-------------|----------|----------|-----------|
| 1 | | U_{os} | | I_{os} | | |
| 1 | Sa | ON | | | | |
| 2 | S1 S2 | | | | | |
| U_{O1} | U_{O1} | | | | | |
| 3 | S1 S2 | | | | | U_{O1}' |
| | U_{O1}' | | | | | |
| 4 | | 1-1 | 1-2 | U_{Os} | I_{Os} | |
| | | Sa | OFF | | | |
| 2 | | A_{ud} | | | | |
| 1 | Sb | ON | | | | |
| 2 | | | U_{i2} | 100Hz | | 50mV |
| | | U_{O2} | | U_{i2} | U_{O2} | |
| 3 | | 1-3 | A_{ud} | | | |
| | | Sb | OFF | | | |
| 3 | | CMRR | | | | |
| 1 | Sc | ON | S3 S5 S7 | | | |
| 2 | | | U_{i3} | 100Hz | | 1V |
| | | U_{O3} | | U_{i3} | U_{O3} | |
| U_{O3} | U_{O3} | A1 | | | | |
| 3 | | 1-4 | CMRR | | | |
| | | Sc | OFF | | | |
| 4 | | U_{oppm} | | | | |
| 1 | Sc | ON | S4 S6 S8 | | | |
| 2 | | | U_{i4} | 100Hz | | |

U_{O4}
 U_{oppm}
 Sc OFF
5 **GW**
 1 Sd ON
 2 U_{i5} 100mV
 SR2

$$A_u = \frac{U_{o5}}{U_{i5}} = 0.707$$

Sd OFF

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1 U_{OS} I_{OS} A_{ud} $CMRR$ U_{oppm} GW
 2
 3

1 U_{OS} I_{OS}

2 U_{OS} I_{OS}

3

4

5

1
2

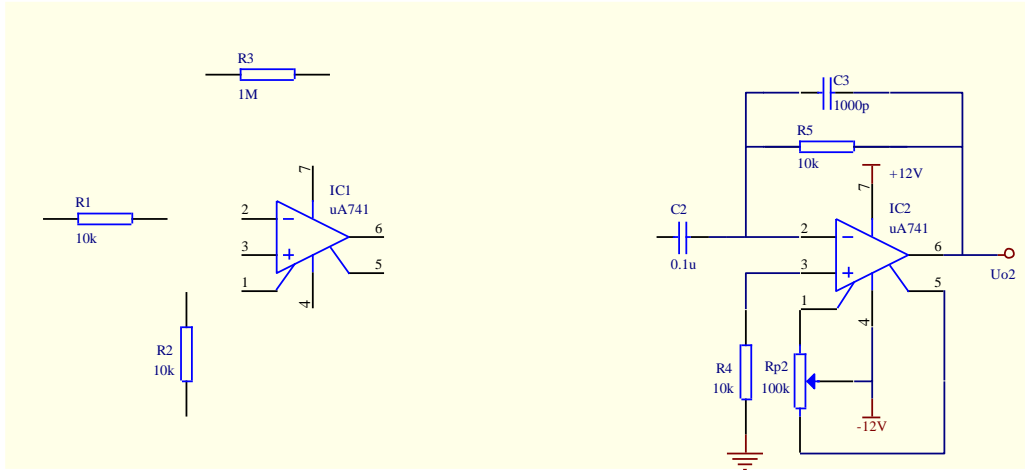
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8-DIP

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2-1

2-1 S1 IC1 仪

$$u_{o1}(t) = -\frac{1}{R_1 C_1} \int u_{i1}(t) dt \quad 2-1$$

3

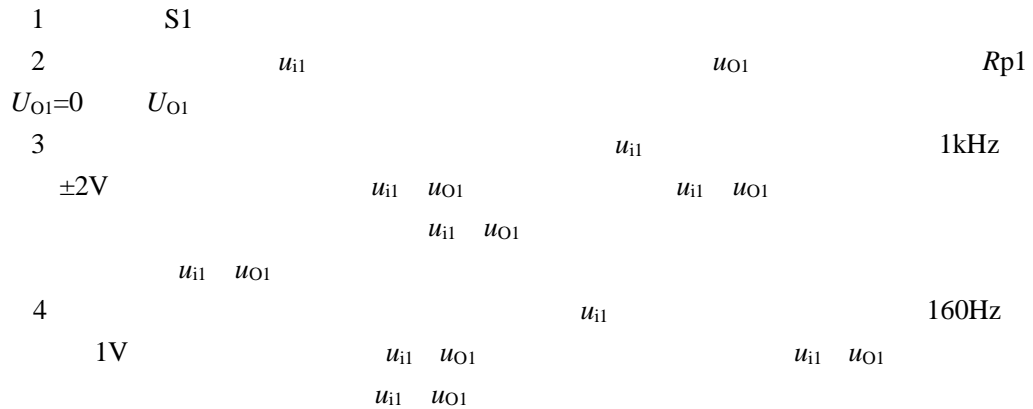
2-1 S1 S2 IC2 仪

$$u_{o2}(t) = -R_5 C_2 \frac{du_{i2}(t)}{dt} \quad 2-2$$

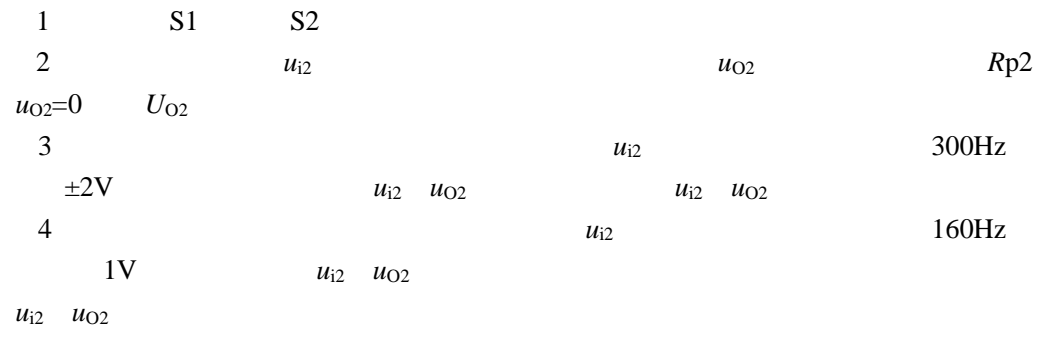
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2-1 S2 S1 IC1 IC2 仪

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- 3

LM311

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2 LM311
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TTL ECL HTL NMOS PMOS

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LM311

1 LM311

LM311 万

±5V ±15V

100nA

6.0nA

±30V

TTL DTL

MOS

LM311

8-DIP

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3-1

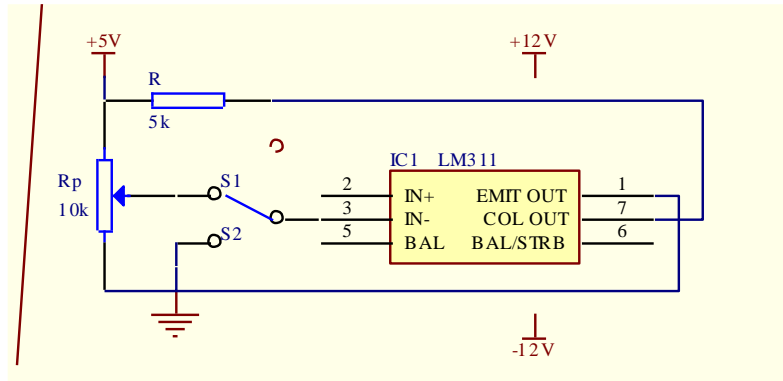
LM311

3-1 LM311

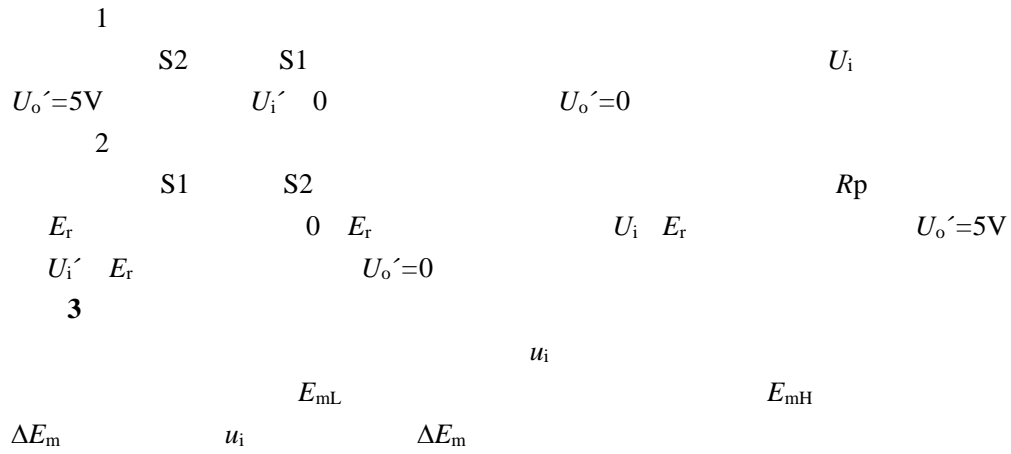
| | | | | | | | |
|---|-----|---|----|---|----------------|---|-----|
| | | | | | | | |
| 1 | GND | 3 | IN | 5 | BALANCE | 7 | OUT |
| 2 | IN+ | 4 | V | 6 | BALANCE/STROBE | 8 | V+ |

2

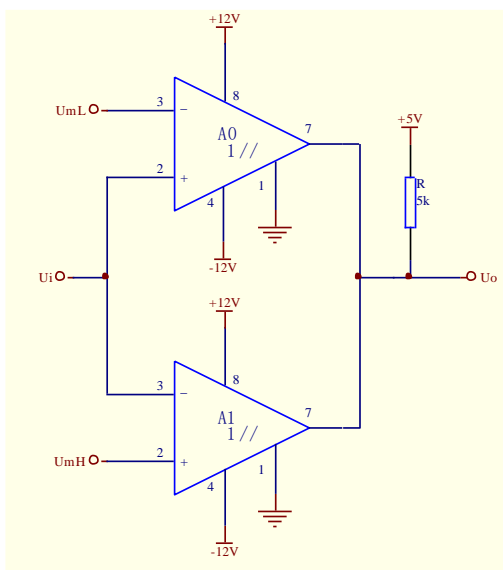
3-1



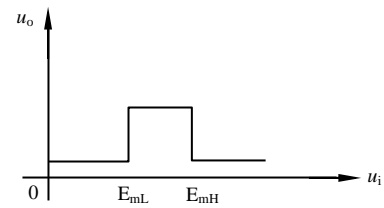
3-1



3-2



3-2



3-3

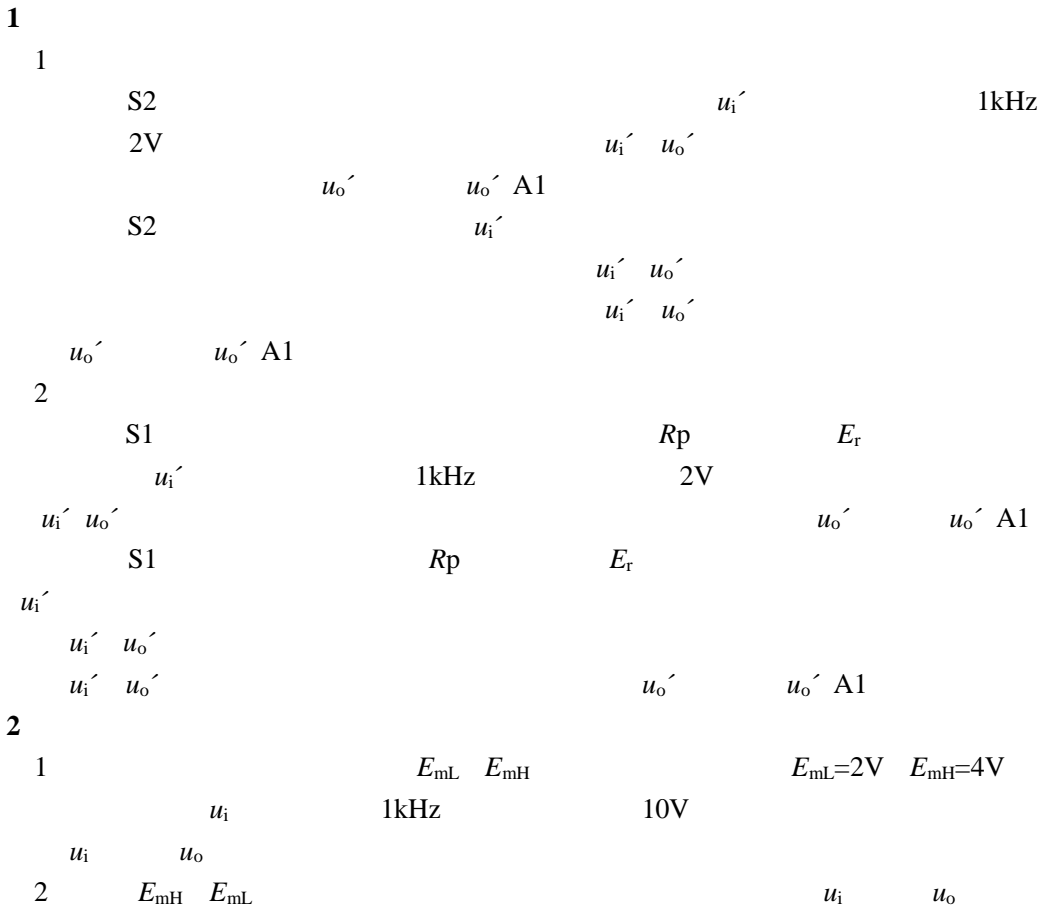
3-2 IC2 IC3 万 LM311 LM311

U_i E_{mL} E_{mH} IC2 IC3

U_i E_{mH} IC2 IC3

E_{mL} U_i E_{mH} IC2 IC3

3-3



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- 1
- 2
- 3

ICL8038

1 ICL8038
 2 ICL8038
 3

1
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1 ICL8038

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ICL8038

0.001Hz 500kHz
 0.5

+10V +30V ±5V ±15V
 50ppm/°C

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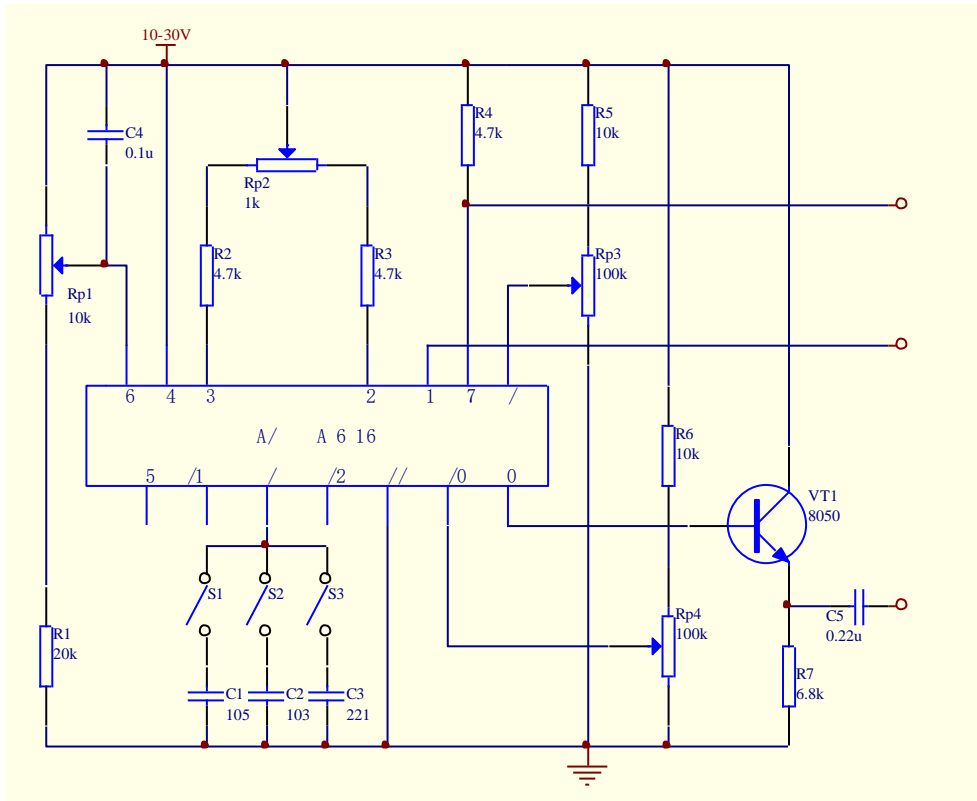
ICL8038 14-DIP 4-1 ICL8038

4-1 ICL8038

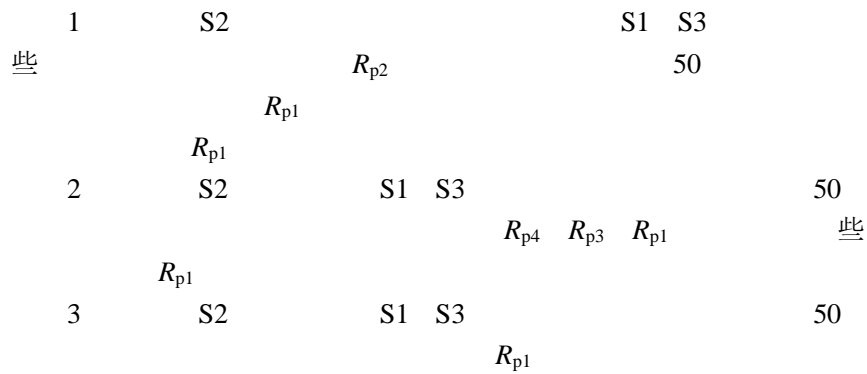
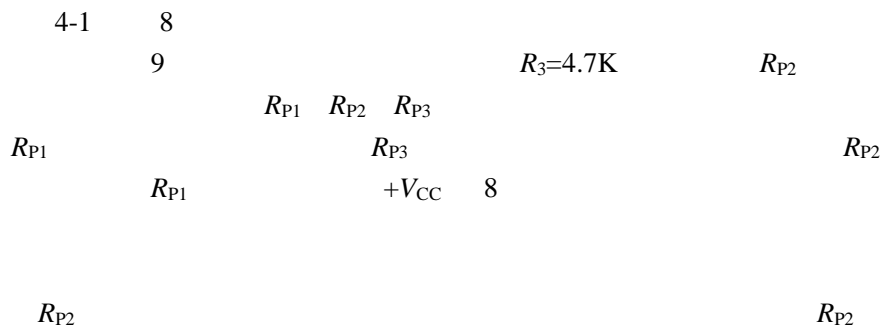
| | | | | | |
|---|-------------------------------|----|------------------|----|-------------------------------|
| 1 | SINE WAVE SINADJ ₁ | 6 | V ₊ | 11 | V OR AND |
| 2 | SINE WAVE OUT | 7 | FM BIAS | 12 | SINE WAVE SINADJ ₂ |
| 3 | TRIANGLE OUT | 8 | FM SWEEP INPUT | 13 | NC |
| 4 | DUTY CYCLE | 9 | SQUARE WAVE OUT | 14 | NC |
| 5 | FREQUENCY DFADJ | 10 | TIMING CAPACITOR | | |

2 ICL8038

4-1 ICL8038



4-1 ICL8038



| | | | | | | | | | |
|----|----|----|--|----------|----------|----------|----------|--|----------|
| 4 | | 3 | | S1 | | S2 | S3 | | S2 |
| | S1 | S3 | | S1 | S2 | | | | R_{p2} |
| 10 | | 90 | | | | | | | |
| 5 | | 4 | | R_{p1} | R_{p2} | R_{p3} | R_{p4} | | |

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|---|--|---|---|---|
| 1 | | 1 | 2 | 3 |
| 2 | | 4 | | |
| 3 | | 5 | | |
| 4 | | | | |