

A/D D/A

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

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

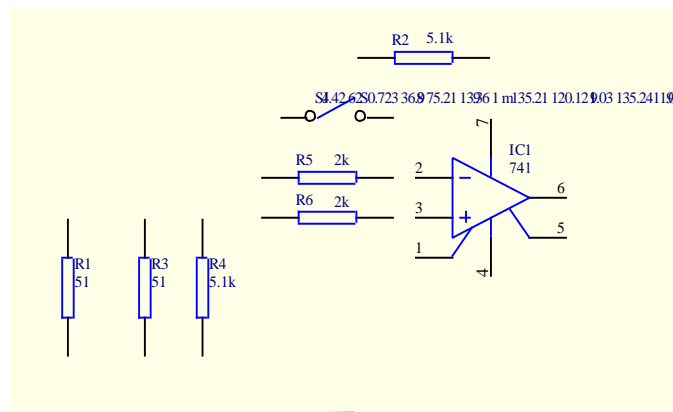
TO-99

2 3 6 7 4

8 1 5 1 5 5

1 5

1-1



1-1

S1 S2

$U_{O1}$

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

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

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

**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**  $A_{ud}$

$$\Delta U_o$$

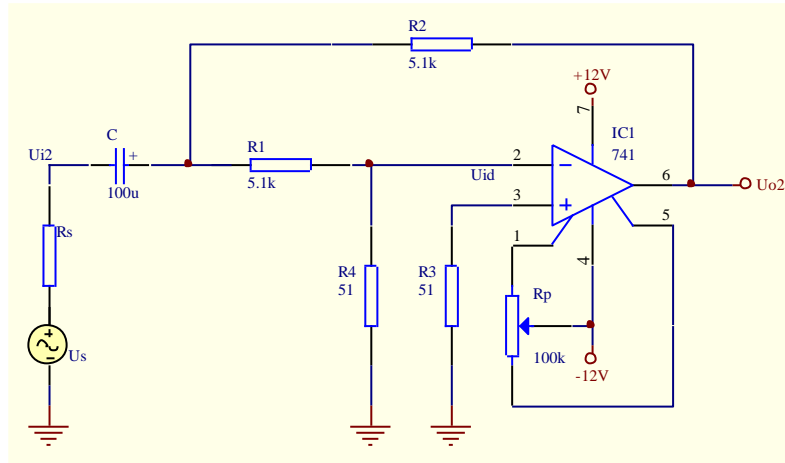
$$\Delta U_{id}$$

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

dB

Hz

1-2



$$A_{ud} = \frac{R_2}{R_1} \cdot \frac{R_1 + R_4}{R_4} \cdot \frac{R_2}{R_s} \cdot \frac{U_{o2}}{U_{i2}} \quad (1-2)$$

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

100dB

4

**CMRR**

$A_{ud}$

$A_{uc}$

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

dB

**CMRR**

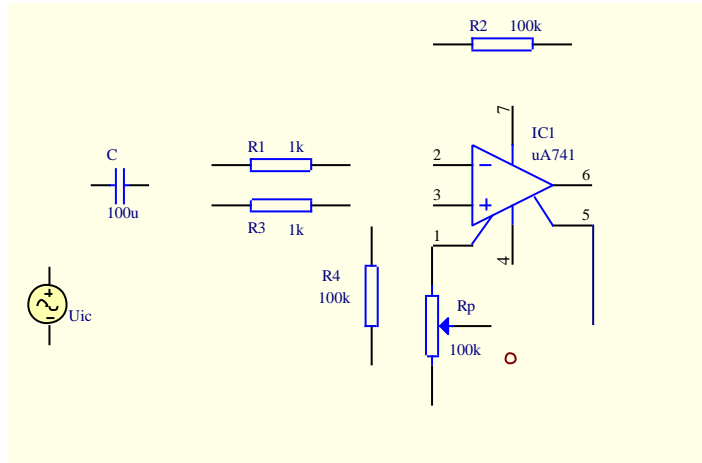
$$CMRR = 20 \lg \left( \frac{A_{ud}}{A_{uc}} \right) (\text{dB})$$

**CMRR**

**CMRR**

1-3

**CMRR**



1-3 *CMRR*

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

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

*CMRR*

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

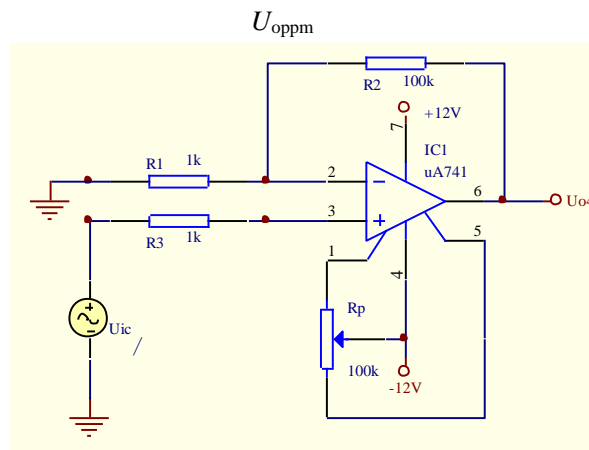
1-4

5

$U_{oc}$   $U_{ic}$  *CMRR* *CMRR* 80dB  
 $U_{oppm}$   
 $U_{oppm}$

10V

1-4



1-4

$U_{oppm}$

6

*GW*

*GW*  
0.707

1

$$GW = A_{ud} f$$

1-5

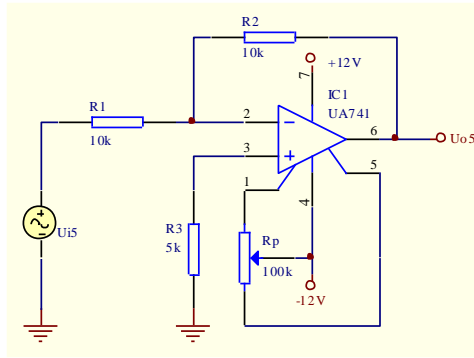


GW

100~200mV

1-5

GW



1-5

GW

<b>1</b>		$U_{os}$		$I_{os}$		
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			
<b>2</b>		$A_{ud}$				
1	Sb	ON				
2		$U_{i2}$		100Hz		50mV
		$U_{O2}$		$U_{i2}$	$U_{O2}$	
3		1-3	$A_{ud}$			
		Sb	OFF			
<b>3</b>		<b>CMRR</b>				
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	<b>CMRR</b>			
		Sc	OFF			
<b>4</b>		$U_{oppm}$				
1	Sc	ON	S4 S6 S8			
2		$U_{i4}$		100Hz		

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

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

Sd OFF

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

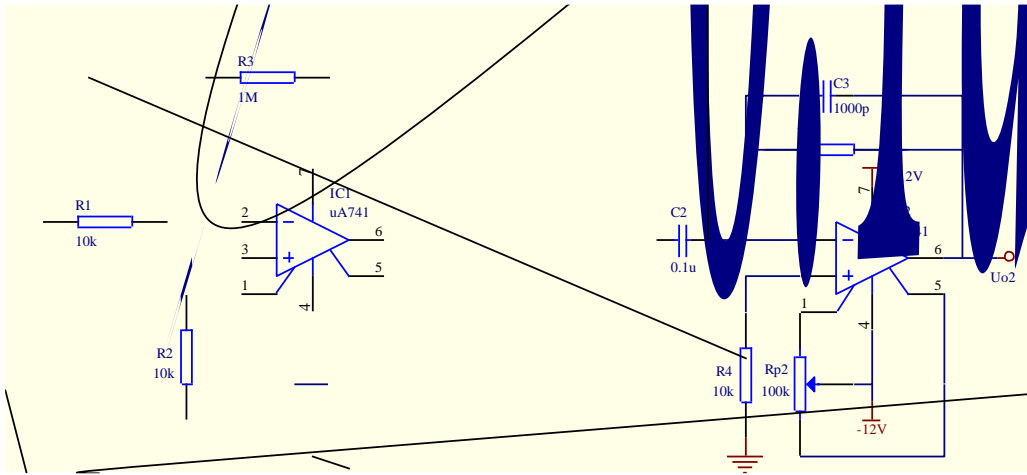
1  
2

1  
2  
3  
4

**1**

8-DIP

TO-99



2-1

2-1                    S1                    IC1

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

3

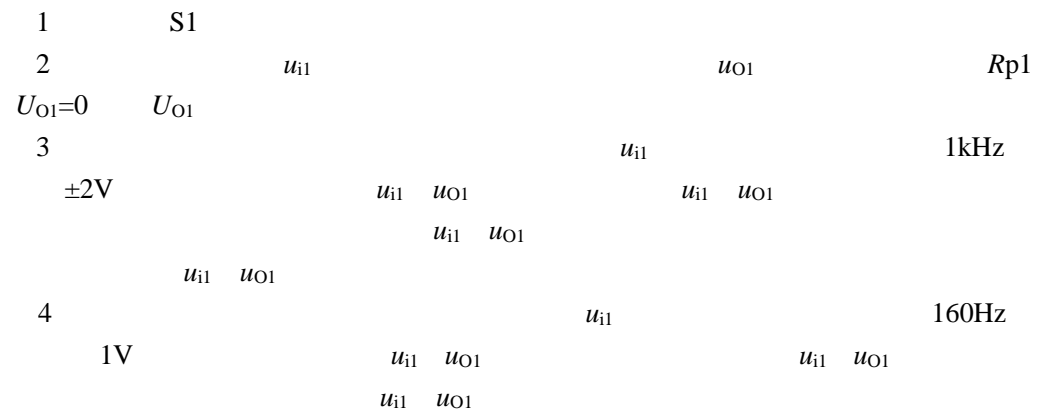
2-1                    S1                    S2    IC2

2-2

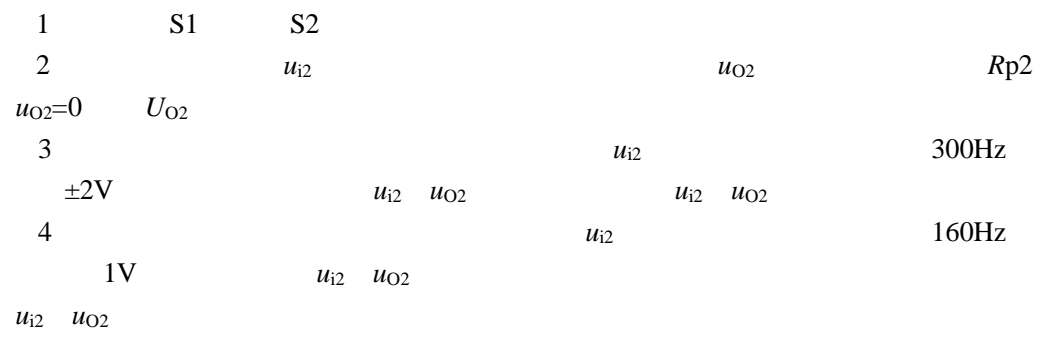
4

2-1                    S2                    S1                    IC1    IC2

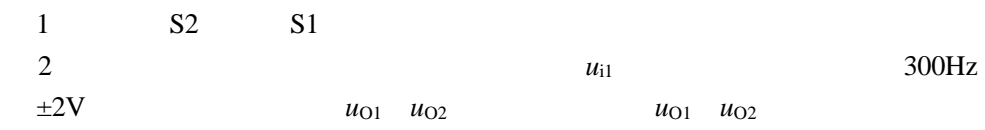
1



**2**



**3**



1

2

3

# LM311

1  
2 LM311  
3

1  
2  
3  
4  
5

3

5ns

TTL ECL HTL NMOS PMOS

LM311

1 LM311

LM311

6.0nA

±30V

±5V ±15V

100nA

TTL DTL MOS

LM311

8-DIP

TO-99

3-1

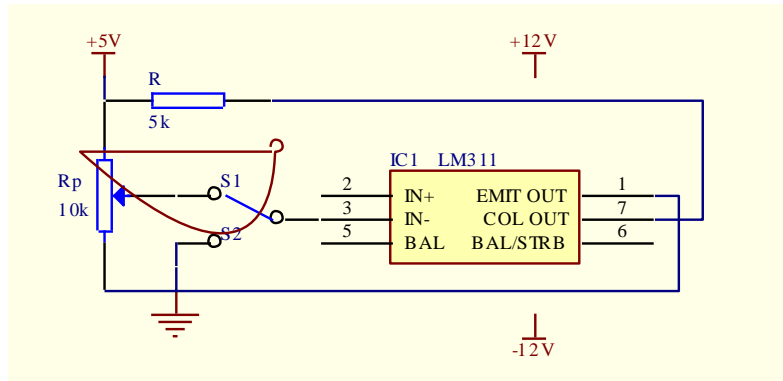
LM311

3-1 LM311

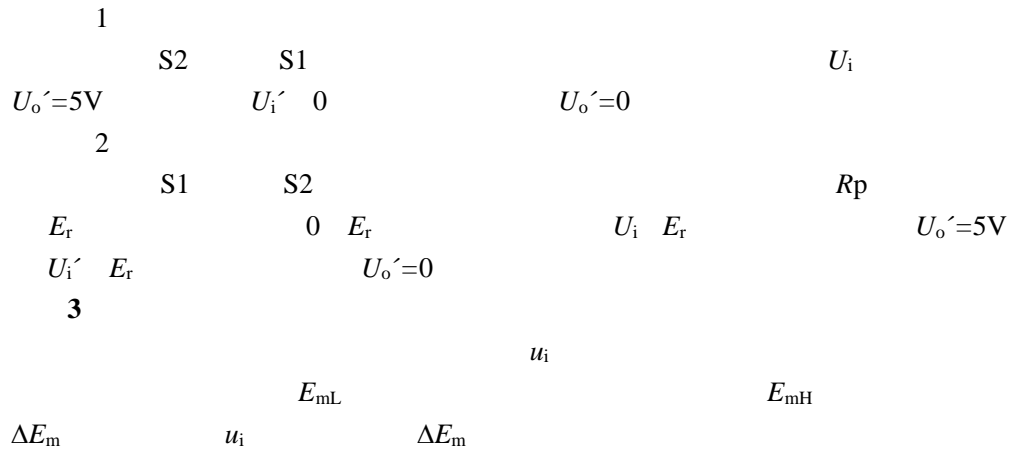
1	GND	3	IN	5	BALANCE	7	OUT
2	IN+	4	V	6	BALANCE/STROBE	8	V+

2

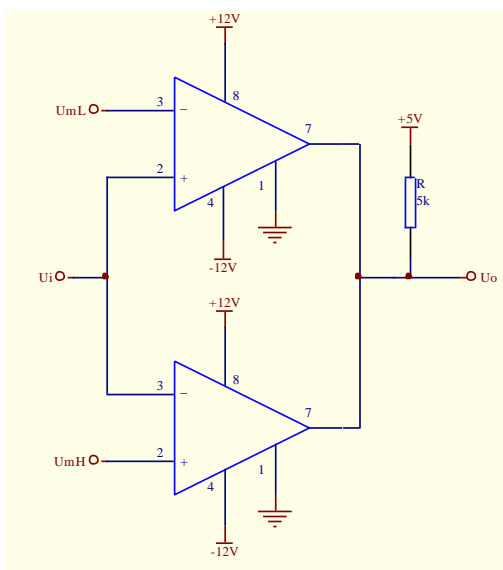
3-1



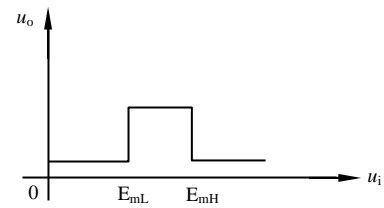
3-1



3-2



3-2



3-3

3-2 IC2 IC3

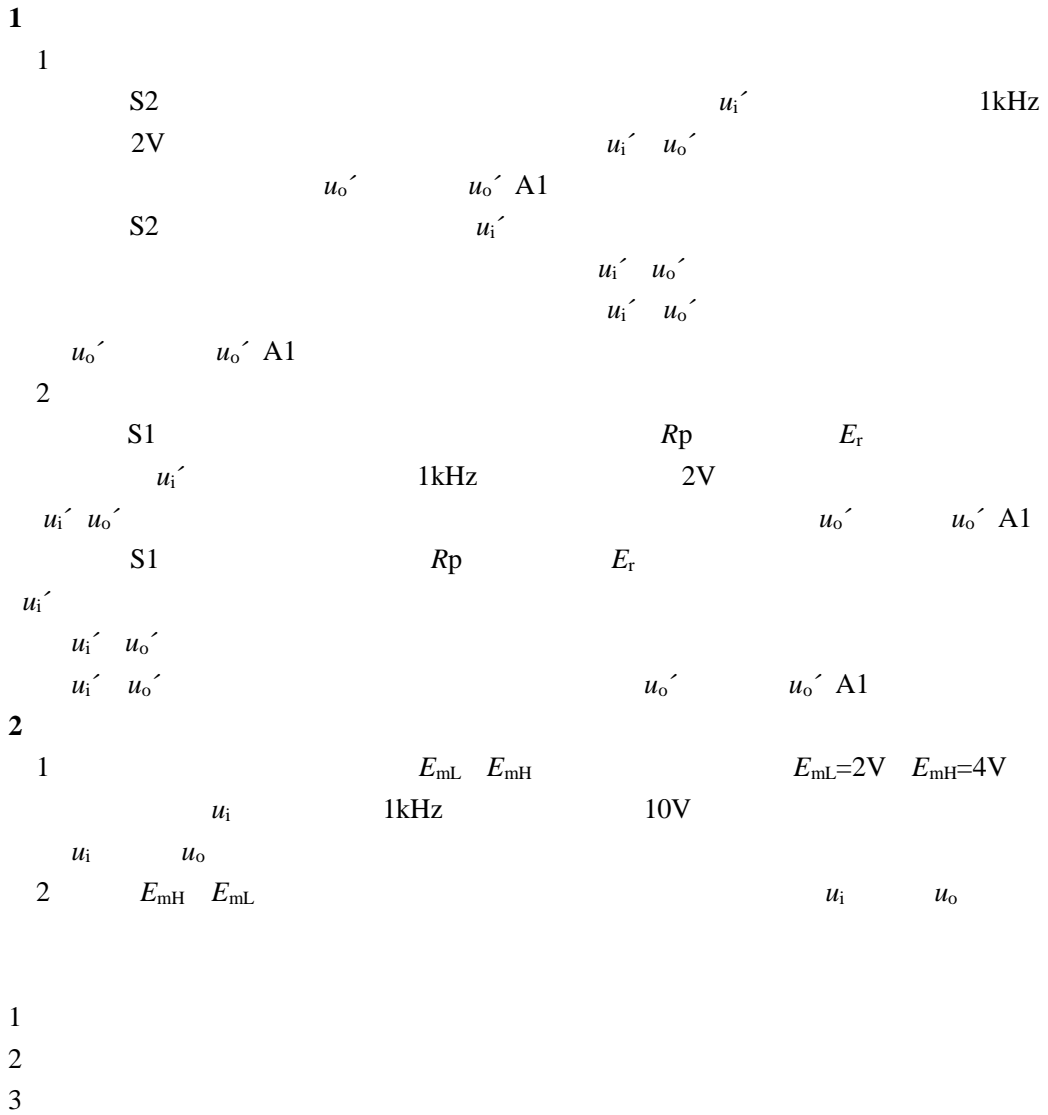
LM311 LM311

$U_i$   $E_{mL}$   $E_{mH}$  IC2 IC3

$U_i$   $E_{mH}$  IC2 IC3

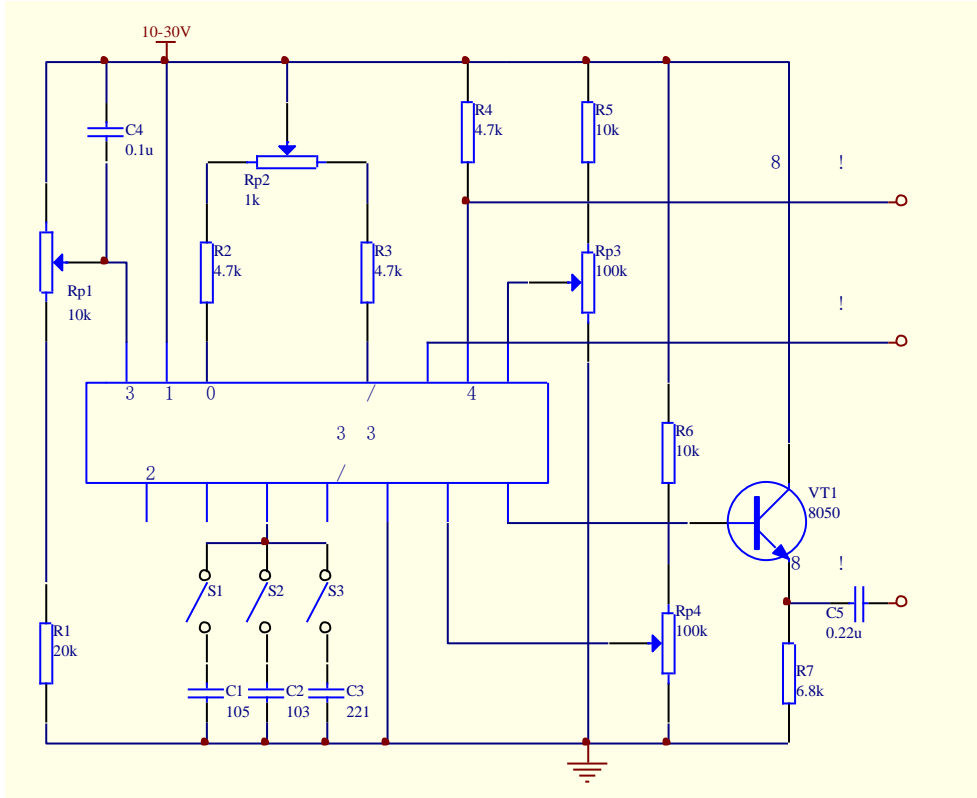
$E_{mL}$   $U_i$   $E_{mH}$  IC2 IC3

3-3

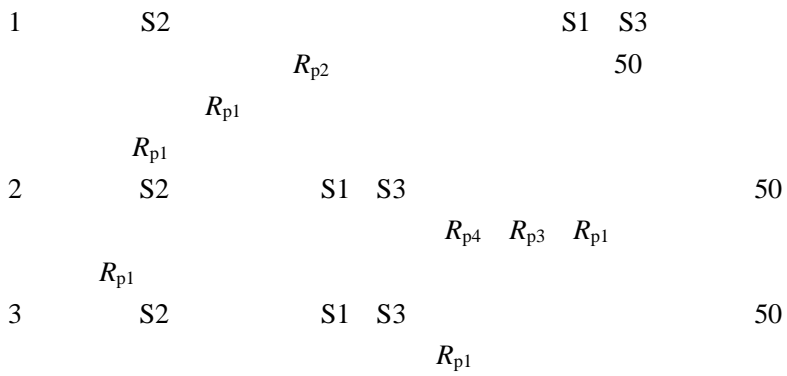
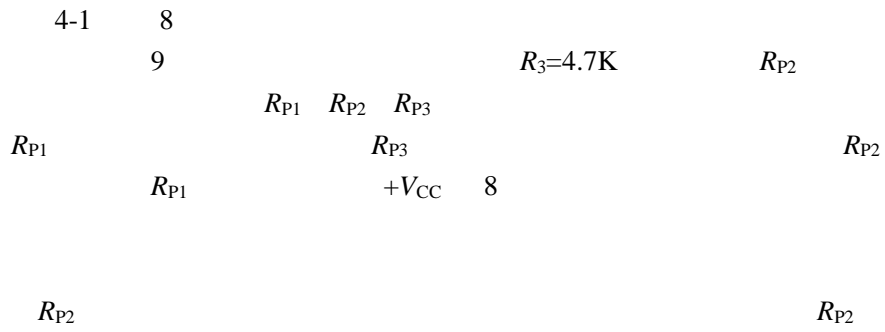








4-1 ICL8038



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

1		1	2	3
2		4		
3		5		
4				