







Vote for  
Voting





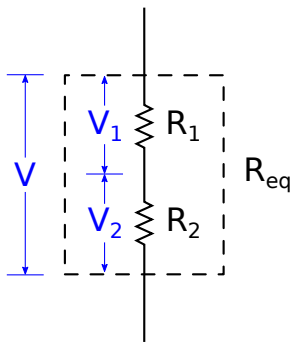




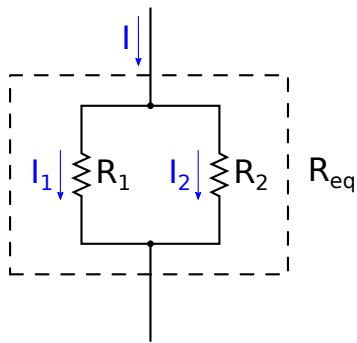




$$P_{\text{diss}} = I^2 R = \frac{V^2}{R}$$



Series  
**(a)**



Parallel  
**(b)**

Rea

Rep

+

R1

+

R2

+

R3

+

...

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

AR 1

AR 2

AR 3







$R_1$  $V$ 

---

 $R_1 + R_2$



$R_2$  $V$ 

---

 $R_1 + R_2$



$R_2$

---

1

$R_1$

+

$R_2$



$$R_1$$

---

$$1$$

$$R_1$$

$$+$$

$$R_2$$

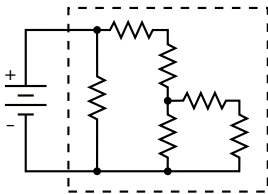




Pr1





















$\Sigma$  $v_i$  $=$  $0$ 

loop

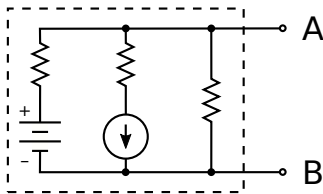


+	-
	
	

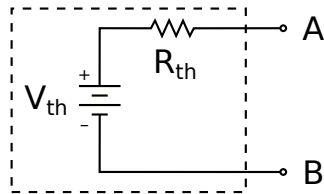
$\Sigma$

$$I_i = 0$$

junction



(a)



(b)



























$$X_C = - \frac{j}{\omega C}$$







$$\operatorname{Re}(v e^{j(wt + \phi_v)}) = v \cos(wt + \phi_v)$$



$$\operatorname{Re}(e^{j\omega t + \phi_i}) = \cos(\omega t + \phi_i)$$











vejo





Revised 1st



Realized  
growth

I

=

V

—

Z

PEWEE WOODPECKER

$$\langle P \rangle = \frac{N}{2} \cos(\phi_v - \phi_i) = \frac{\sqrt{2}}{2} \cos(\phi_v - \phi_i)$$

cos<sup>2</sup>(wt)

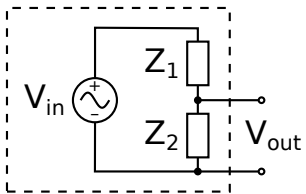












winning 1200

v

out

=

22

$$v_{out} = \frac{Z_2}{Z_1 + Z_2} v_{in}$$

v

out

$$V_{out} = \sqrt{V_{out} * V_{out}}$$





$$\tan \phi = \frac{\operatorname{Im} \left( \frac{Z_2}{Z_1 + Z_2} \right)}{\operatorname{Re} \left( \frac{Z_2}{Z_1 + Z_2} \right)}$$



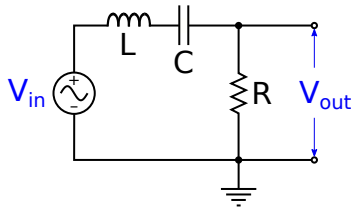
$$A_v = \frac{V_{out}}{V_{in}} = \frac{|V_{out}|}{|V_{in}|} = \left| \frac{Z_2}{Z_1 + Z_2} \right| = \sqrt{\left( \frac{Z_2}{Z_1 + Z_2} \right)^* \left( \frac{Z_2}{Z_1 + Z_2} \right)}$$



$A_v$

$=$

$\frac{1}{\sqrt{2}}$





$$Z_1 = j \left( \omega L - \frac{1}{\omega C} \right)$$



$$\frac{V_{out}}{V_{in}} = \sqrt{\frac{R^2}{R^2 + (\omega L - 1/\omega C)^2}}$$



$$\frac{Z_2}{Z_1 + Z_2} = \frac{R}{R + j\left(\omega L - \frac{1}{\omega C}\right)} = \frac{R^2 - jR\left(\omega L - \frac{1}{\omega C}\right)}{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

$$\tan \phi = \frac{\frac{1}{\omega C} - \omega L}{R}$$

Vote for  
the

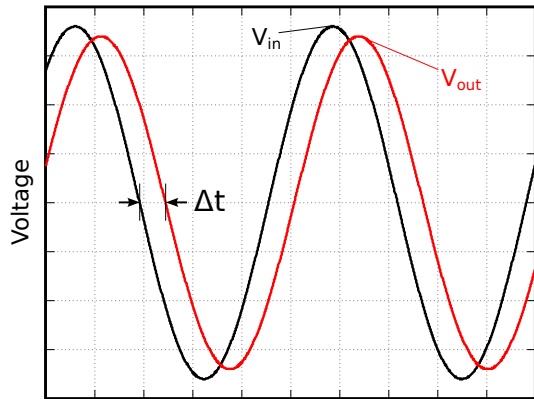
Went to



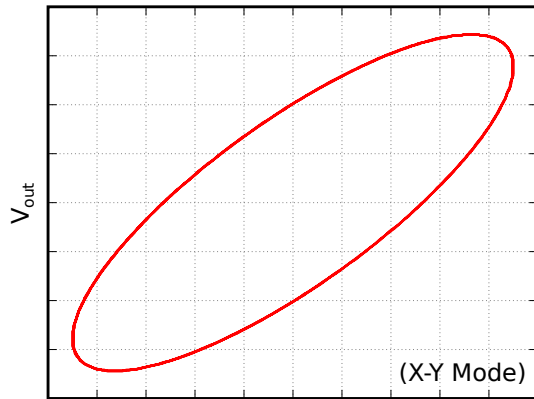
$$\Delta t = \frac{\phi}{\omega} = \frac{\phi}{2\pi f} = \frac{\phi}{2\pi} T$$



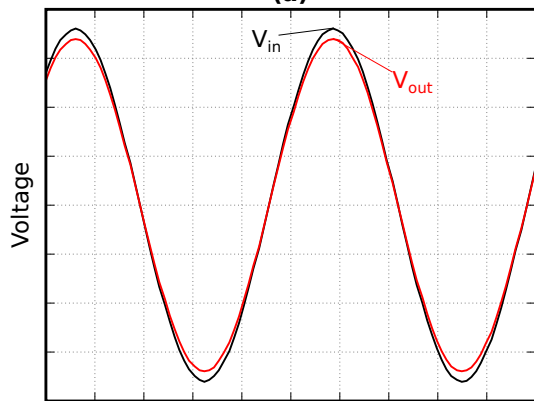




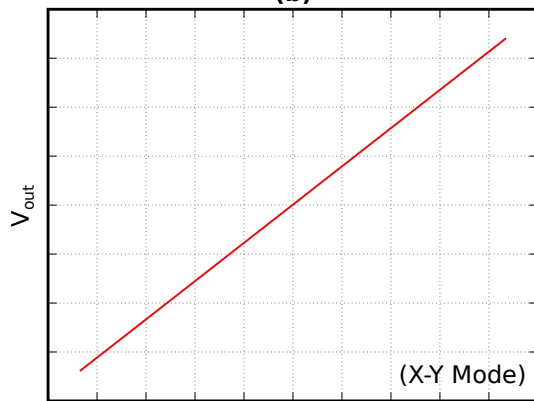
**(a)**



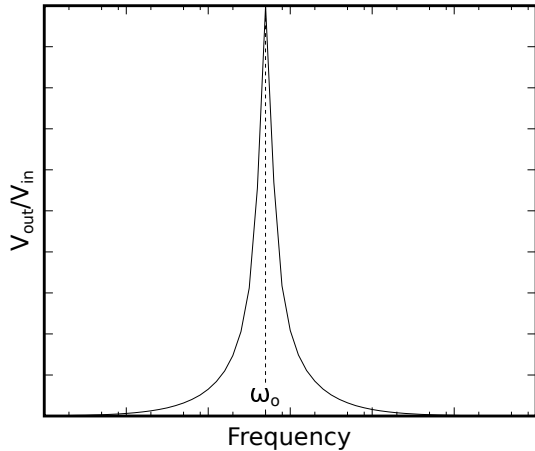
**(b)**



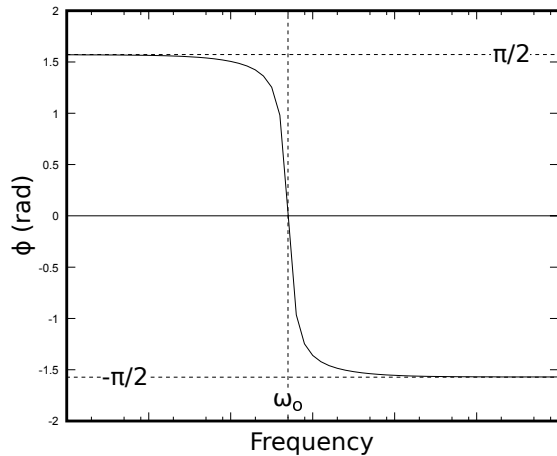
**(c)**



**(d)**



**(a)**



**(b)**

love

—

win





$$\omega_0 = \frac{1}{\sqrt{LC}}$$

love





A

v

=

v

o

v

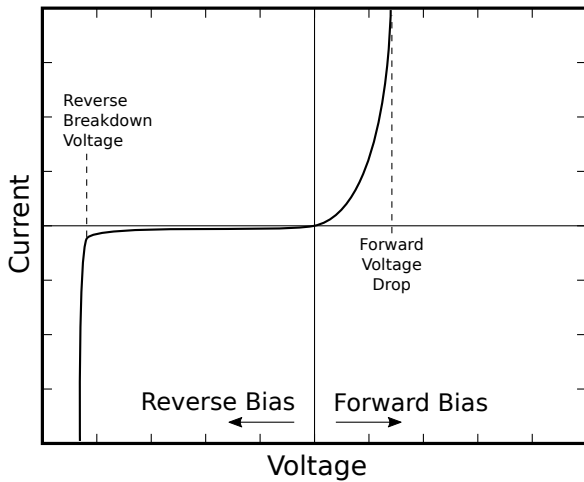
t

/

v

n





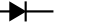


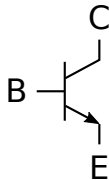
1

0

→

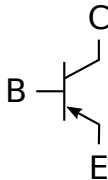
0





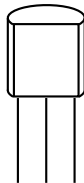
NPN

**(a)**



PNP

**(b)**



E B C

**(c)**





VERE

$$I_C = I_0 \left( e^{\frac{V_{BE}}{kT/e}} - 1 \right)$$



9

=

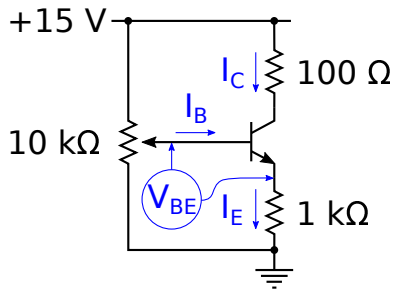
10

x

10-

10

130x10-22









$$r_e = \frac{dV_{BE}}{dI_C} = \frac{kT/e}{I_C}$$

A pixelated, black and white graphic of the text "25 Years". The numbers "25" are on the left, followed by a large, stylized "R", and the word "Years" is on the right. The font is a bold, blocky, pixelated style.

VE

WE

SE

0.

25





10

11

12

13







VEREINIGTE  
NATIONEN

10

11

12

13

h

FE

se

1

0

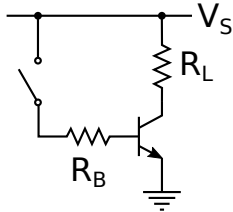
0

VERGE OF



re=2522/252  
ma







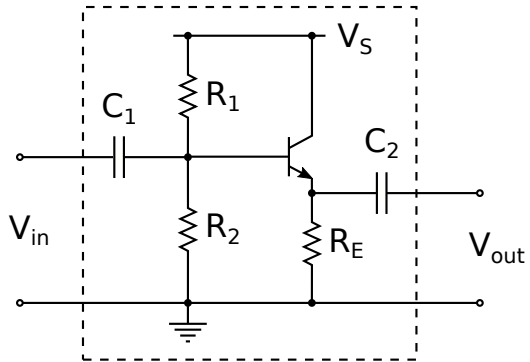








A pixelated, black and white graphic of the text "100% for 2". The text is rendered in a stylized, blocky font with a dithered or pixelated appearance. The "1" is a simple vertical bar with a horizontal top and bottom. The "0" is a circle with a thick border. The "00" is followed by a percentage sign "%". The word "for" is in a lowercase, slightly irregular font. The "2" is also in a similar lowercase, blocky font. The entire graphic is set against a white background.











AR 12

VB

es

VE

+

0

.

0

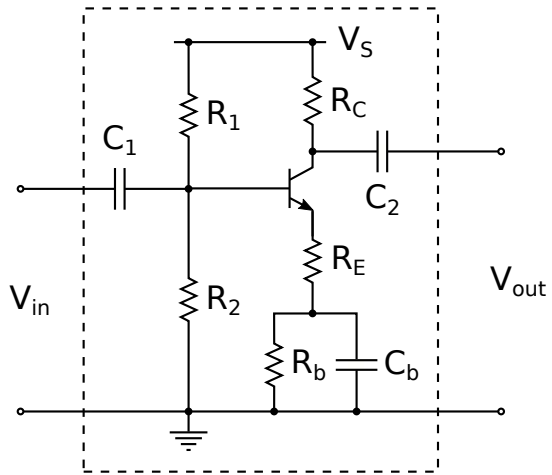
v

APPAREL

Q1







$$A_v = - \frac{R_C}{R_E}$$















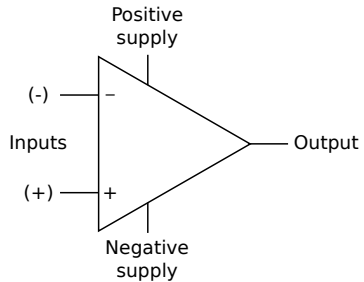
AR1|AR2|AR3|AR4|AR5|AR6|AR7|AR8|AR9|AR10

R1

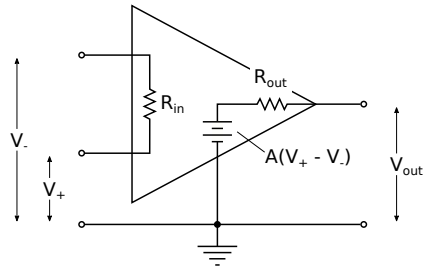
||

R2

REPAIR + REPAIR



**(a)**



**(b)**



A pixelated, black and white graphic of the letters 'V' and 'S'. The 'V' is on the left, and the 'S' is on the right. The letters are composed of a grid of black and white pixels, giving them a jagged, digital appearance. The 'V' is formed by a series of black pixels on a white background, with some gray pixels at the edges. The 'S' is also formed by black pixels, with a similar pixelated style. The overall image is a simple, stylized representation of the letters 'VS'.



A pixelated, black and white graphic of the letters 'VSE' in a stylized, blocky font. The letters are composed of a grid of black and gray pixels, giving them a digital or retro aesthetic. The 'V' is on the left, the 'S' is in the middle, and the 'E' is on the right. The overall style is reminiscent of early computer graphics or video game sprites.

A pixelated, black and white graphic of the letters 'V' and 'S'. The 'V' is on the left, and the 'S' is on the right. The letters are composed of a grid of black and white pixels, giving them a jagged, digital appearance. The 'V' is formed by a vertical line on the left and a diagonal line on the right. The 'S' is formed by a horizontal line at the top, a vertical line on the right, and a horizontal line at the bottom. The overall style is reminiscent of early computer graphics or video game sprites.



A pixelated, black and white graphic of the number 5. The number is composed of a grid of black and gray pixels on a white background, giving it a digital or retro aesthetic. The strokes are thick and blocky, with some internal pixelation visible. The number 5 is positioned on the right side of the image, while the left side is mostly empty white space.









Power

—

0



103

105



Run = 10, ASD, Rvd, Rvd



vs + = vs = vs

V+

W

V-

-

W

V

out

-

W

V+

✓

V\_

≡

Vout

≡

—

Vs

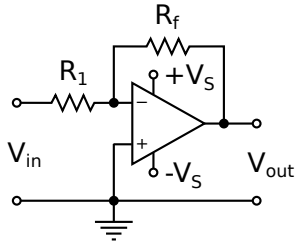
1

0

1

2

2





$$I = \frac{V_{in}}{R_1} = \frac{-V_{out}}{R_f}$$

$$A_v = -\frac{R_f}{R_1}$$



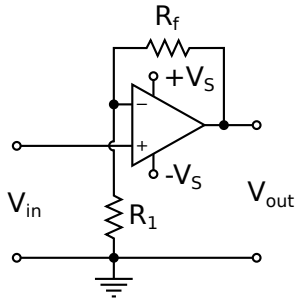
ROZ

||

RF

Rece

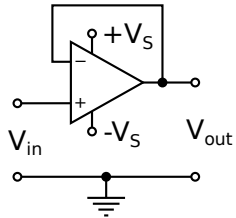




$$V_{in} = \frac{R_1}{R_1 + R_f} V_{out}$$

$$A_v = 1 + \frac{R_f}{R_1}$$

ARCADE + ARCADE

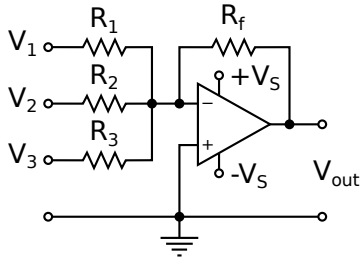












V1

\_\_\_\_\_

R1

V2

\_\_\_\_\_

R2



V3

\_\_\_\_\_

R3





$V_{out}$



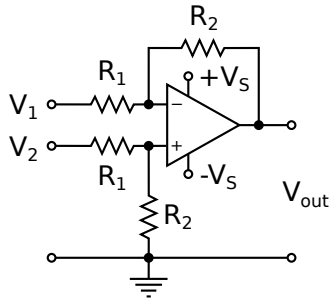
$R_f$



$$V_{out} = - \left( \frac{R_1}{R_f} V_1 + \frac{R_2}{R_f} V_2 + \frac{R_3}{R_f} V_3 \right)$$

Pr

Pr





$V_1$

—

$V_2$

---

$R_1$



$V_2$

$-$

$V_+$

---

$R_1$

$$V_{-} - V_{out}$$

---

$$R_2$$



V

+

—

R<sub>2</sub>

$$V_+ = \frac{R_2}{R_1 + R_2} V_2$$

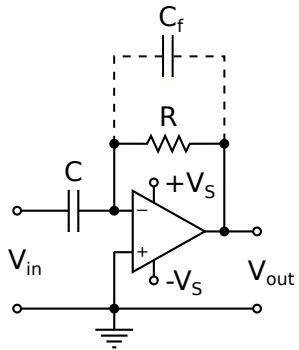


$$v_{out} = -\frac{R_2}{R_1}(v_1 - v_2)$$













W

out

—

—

R

$$V_{in} = \frac{Q}{C}$$

1

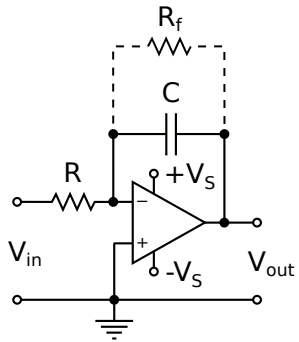
=

$\frac{dQ}{dt}$

$$V_{out} = -RC \frac{dV_{in}}{dt}$$







$I$

$=$

$$\frac{V_{in}}{R}$$

$$V_{out} = -\frac{Q}{C}$$



$$Q = \int dq = \frac{1}{R} \int v_{in} dt$$

$$V_{out} = -\frac{1}{RC} \int V_{in} dt$$



DC  
Voltage  
Source



Resistor



Capacitor



Inductor



DC  
Current  
Source



Potentiometer



Ground



Diode



AC  
Source



NPN  
Transistor



PNP  
Transistor

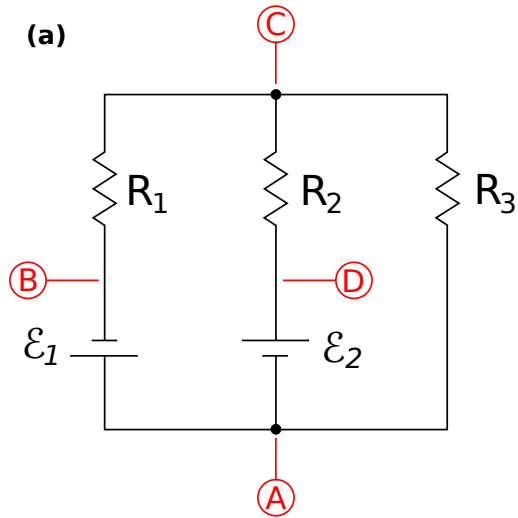


Op Amp

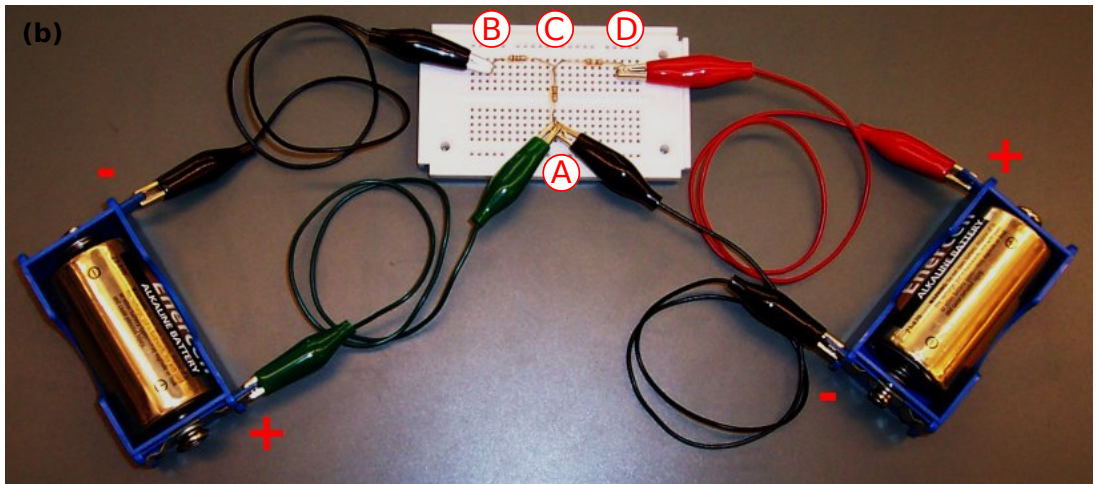


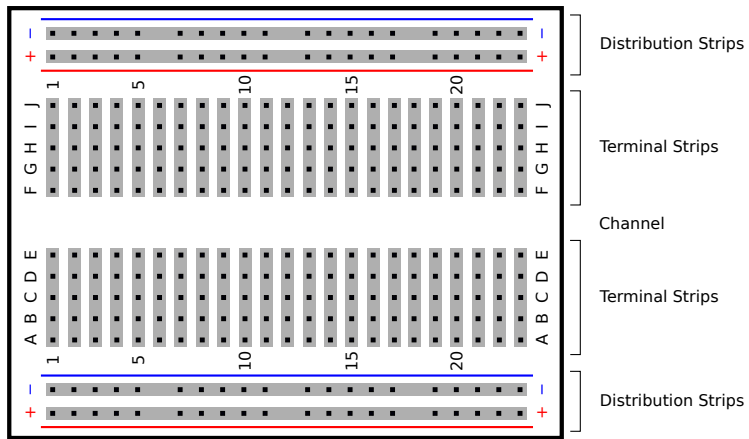


(a)



(b)



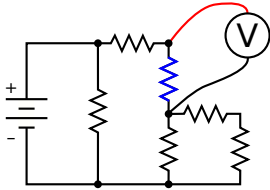


<b>color</b>	black	brown	red	orange	yellow	green	blue	violet	gray	white
<b>digit</b>	0	1	2	3	4	5	6	7	8	9
<b>multiplier</b>	1	10	100	1k	10k	100k	1M	10M	100M	1000M

$$R = [\text{band1}][\text{band2}] \times 10^{[\text{band3}]} \quad \begin{array}{l} \pm 5\% \text{ (gold)} \\ \pm 10\% \text{ (silver)} \end{array}$$

$$A \equiv 64 \times 10^2 \quad 2 \equiv 64 \times 100 \quad 2 \equiv 6400 \quad 2$$

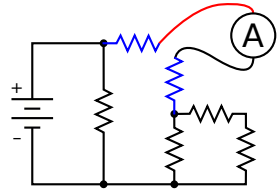
13202



**(a)**



**(b)**



**(c)**

T n n n n e 1



T H N E S

$$dB = 10 \log \left( \frac{\text{Thing}_2}{\text{Thing}_1} \right)$$

Thinner

100

Thinning 1

1

0

—

1

2



$$10 \log \left( \frac{P_{out}}{P_{in}} \right) = 10 \log \left( \frac{1}{2} \right) = 10(-0.3010) = -3.01$$





A pixelated, black and white representation of the word "WOW". The letters are thick and blocky, with a jagged, pixelated edge. The "W" is on the left, followed by a small space, then the "O", and finally the "W" on the right. The entire image is composed of a grid of black and white squares, giving it a retro, digital appearance.

1

2

3

4