# Electronics
# Resistors and Resistance

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Current and voltage must be measured with power applied to the circuit

# Resistors in Circuit Diagrams

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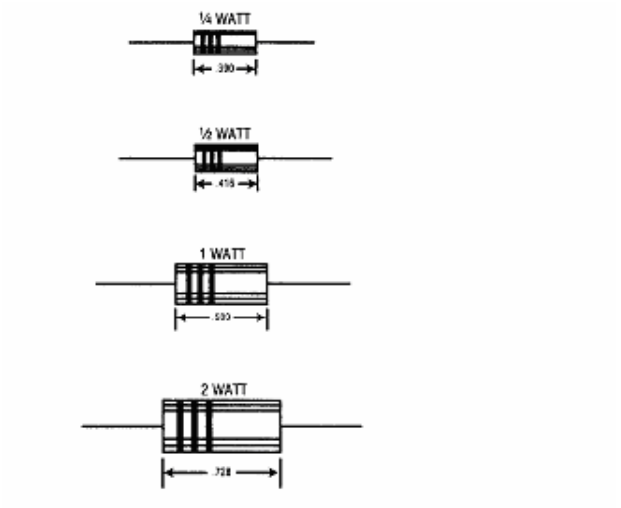
Resistor symbols

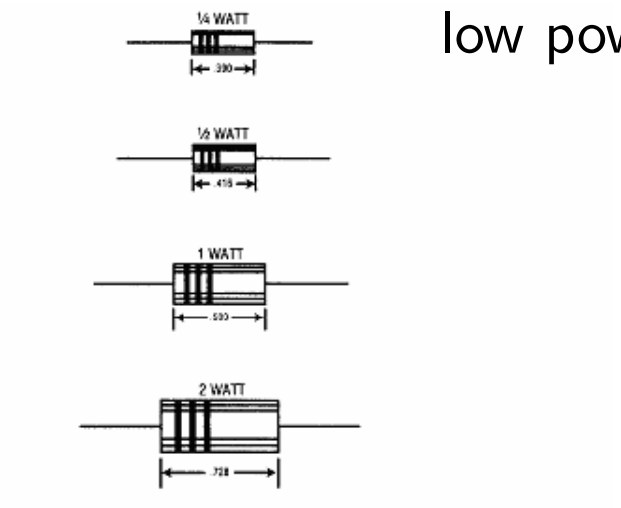
# Resistors in Circuit Diagrams

Resistor symbols

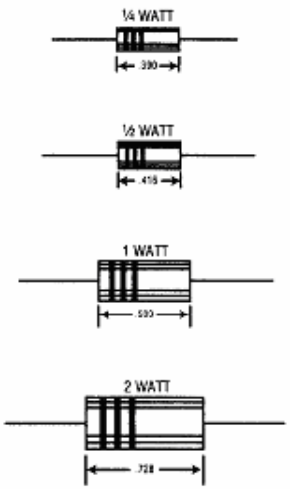
North American

European


¼ WATT
½ WATT
1 WATT
2 WATT

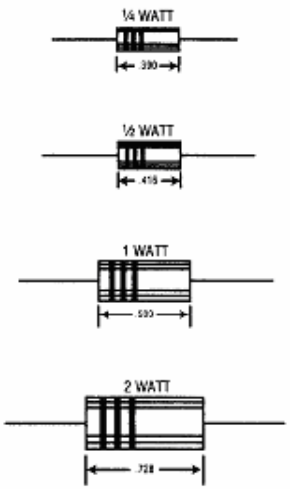



low power; 1/4 W




low power; 1/4 W

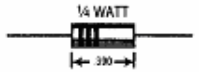
medium power; 1/2 W




low power; 1/4 W

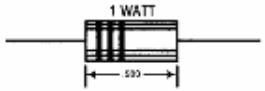
medium power; 1/2 W

medium high power; 1 W

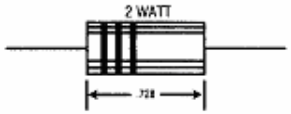



low power; 1/4 W

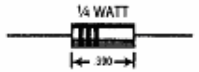

medium power; 1/2 W




medium high power; 1 W

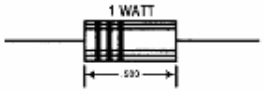



high power; 2 W

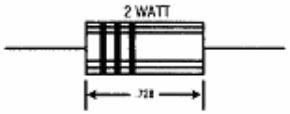



low power; 1/4 W


medium power; 1/2 W

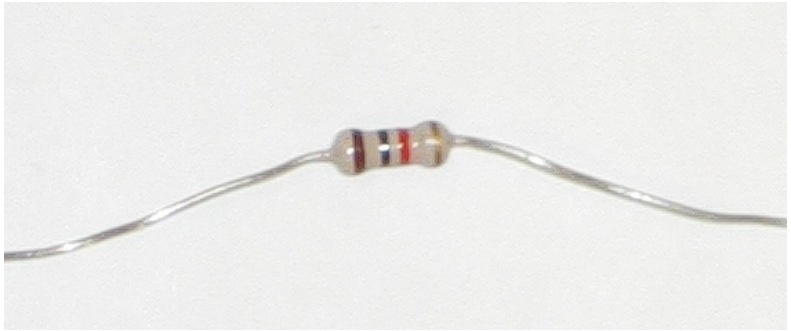



medium high power; 1 W

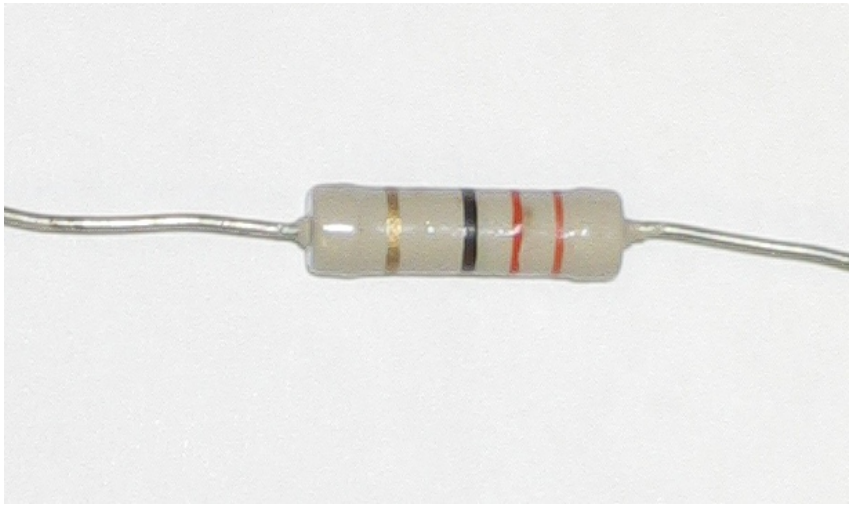



high power; 2 W

Higher power resistors are bigger so they can dissipate more heat.

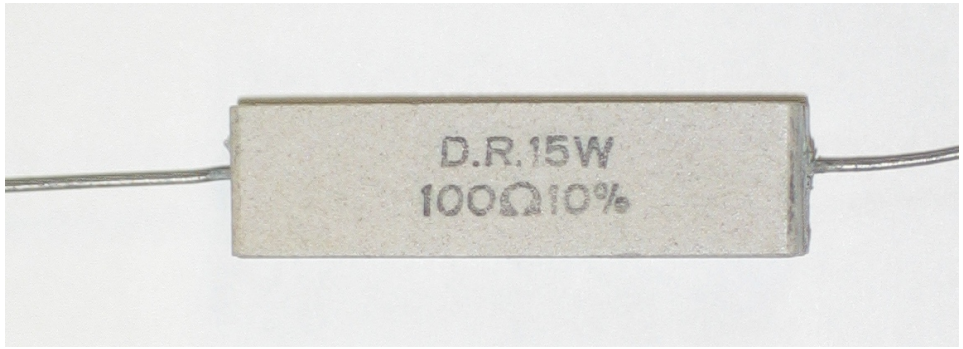


"Normal" (i.e. 1/4 W ) resistor

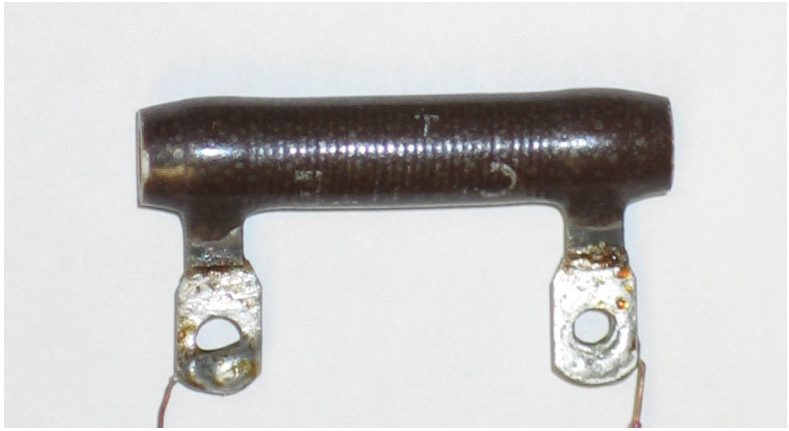


1/2 W resistor

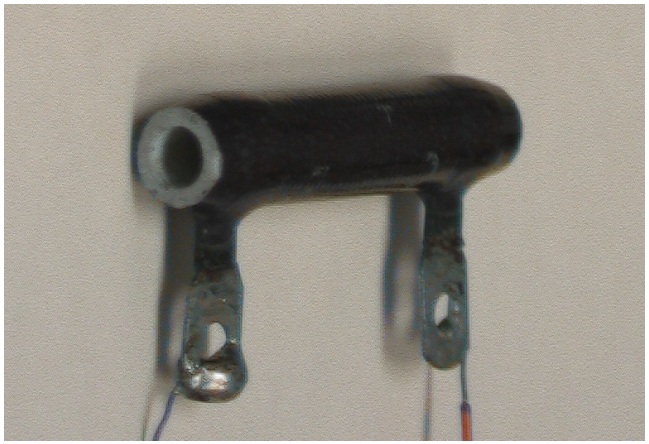

One kind of high power resistor (fins)




The wattage is indicated on this resistor.



High power hollow resistor



High power hollow resistor (end view)

- Always measure resistance by ohmmeter when the power is off *but never when the power is on*.

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- *Determine resistance* based on ohm's law using the voltage across the resistor and the current passing through it.

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- *Determine resistance* based on ohm's law using the voltage across the resistor and the current passing through it.
- **The most reliable measurement will be with the resistor removed from any circuit.**

# Resistor Colour Codes

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Colour codes

- allow resistors to be identified visually

# Resistor Colour Codes

Colour codes

- allow resistors to be identified visually
- are international

# Colour Codes

# Colour Codes

- Better (Black - 0)

# Colour Codes

- Better (Black - 0)
- Be (Brown - 1)

# Colour Codes

- Better (Black - 0)
- Be (Brown - 1)
- Right (Red - 2)

# Colour Codes

- Better (Black - 0)
- Be (Brown - 1)
- Right (Red - 2)
- Or (Orange - 3)

# Colour Codes

- Better (Black - 0)
- Be (Brown - 1)
- Right (Red - 2)
- Or (Orange - 3)
- Your (Yellow - 4)

# Colour Codes

- Better (Black - 0)
- Be (Brown - 1)
- Right (Red - 2)
- Or (Orange - 3)
- Your (Yellow - 4)
- Great (Green - 5)

# Colour Codes

- Better (Black - 0)
- Be (Brown - 1)
- Right (Red - 2)
- Or (Orange - 3)
- Your (Yellow - 4)
- Great (Green - 5)
- Big (Blue - 6)

# Colour Codes

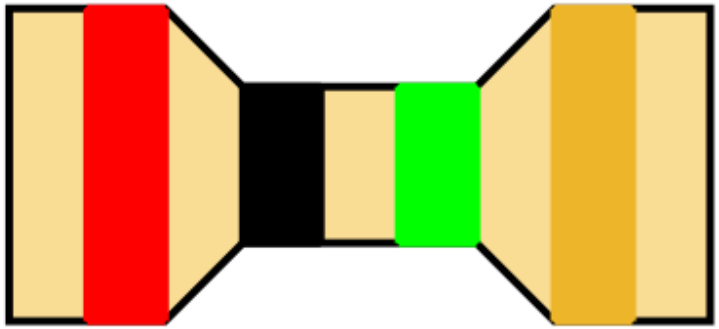
- Better (Black - 0)
- Be (Brown - 1)
- Right (Red - 2)
- Or (Orange - 3)
- Your (Yellow - 4)
- Great (Green - 5)
- Big (Blue - 6)
- Venture (Violet - 7)

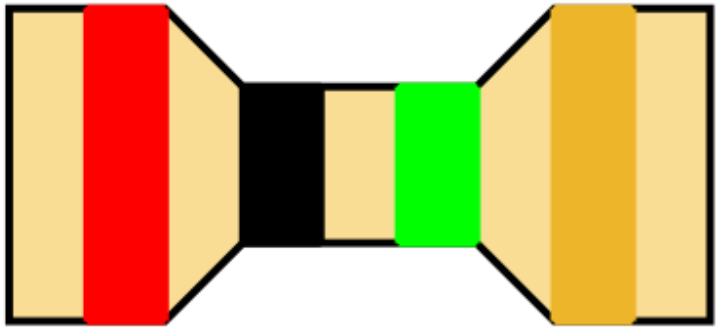
# Colour Codes

- Better (Black - 0)
- Be (Brown - 1)
- Right (Red - 2)
- Or (Orange - 3)
- Your (Yellow - 4)
- Great (Green - 5)
- Big (Blue - 6)
- Venture (Violet - 7)
- Goes (Grey - 8)

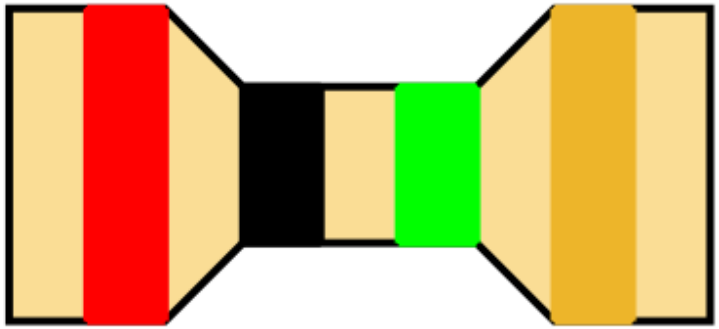
# Colour Codes

- Better (Black - 0)
- Be (Brown - 1)
- Right (Red - 2)
- Or (Orange - 3)
- Your (Yellow - 4)
- Great (Green - 5)
- Big (Blue - 6)
- Venture (Violet - 7)
- Goes (Grey - 8)
- Wrong (White - 9)

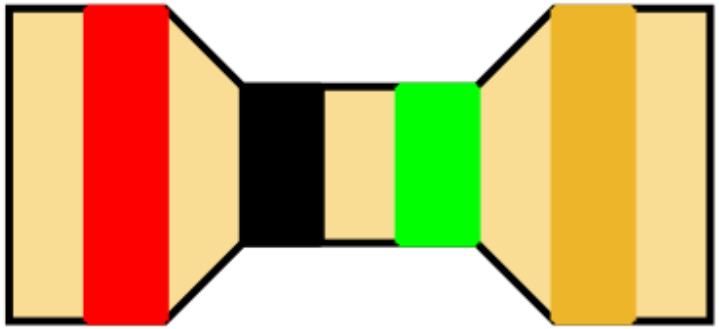




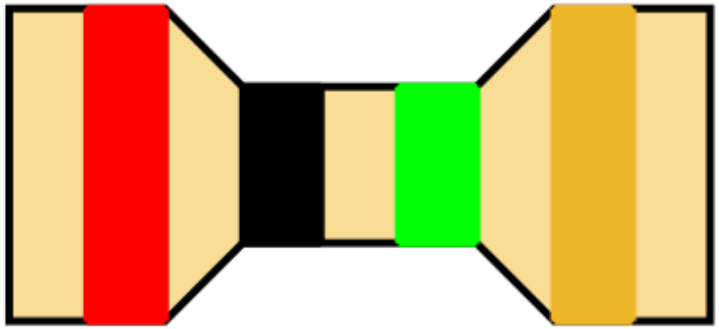
- First 2 bands give prefix; eg. 20 (Red Black)



- First 2 bands give prefix; eg. 20 (Red Black)
- Third band gives multiplier; eg. 5 (Green)



- First 2 bands give prefix; eg. 20 (Red Black)
- Third band gives multiplier; eg. 5 (Green)
- Fourth band gives tolerance; eg. 5% (Gold)



- First 2 bands give prefix; eg. 20 (Red Black)
- Third band gives multiplier; eg. 5 (Green)
- Fourth band gives tolerance; eg. 5% (Gold)
- Result $20 \times 10^5 \pm 5\%$

- First 3 bands give prefix; eg. 205 (Red Black Green)

- First 3 bands give prefix; eg. 205 (Red Black Green)
- Fourth band gives multiplier; eg. 0 (Black)

- First 3 bands give prefix; eg. 205 (Red Black Green)
- Fourth band gives multiplier; eg. 0 (Black)
- Fifth band gives tolerance; eg. 1% (Brown)

- First 3 bands give prefix; eg. 205 (Red Black Green)
- Fourth band gives multiplier; eg. 0 (Black)
- Fifth band gives tolerance; eg. 1% (Brown)
- Result $205 \times 10^0 \pm 1\%$

# 3 or 4 Band Tolerance Colour Codes

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- Gold - 5%

# 3 or 4 Band Tolerance Colour Codes

- Gold - 5%
- Silver - 10%

# 3 or 4 Band Tolerance Colour Codes

- Gold - 5%
- Silver - 10%
- No band - 20%

# 5 or 6 Band Tolerance Colour Codes

# 5 or 6 Band Tolerance Colour Codes

- Black NA

# 5 or 6 Band Tolerance Colour Codes

- Black NA
- Brown 1%

# 5 or 6 Band Tolerance Colour Codes

- Black NA
- Brown 1%
- Red 2%

# 5 or 6 Band Tolerance Colour Codes

- Black NA
- Brown 1%
- Red 2%
- Orange 3%

# 5 or 6 Band Tolerance Colour Codes

- Black NA
- Brown 1%
- Red 2%
- Orange 3%
- Yellow 4%

# 5 or 6 Band Tolerance Colour Codes

- Black NA
- Brown 1%
- Red 2%
- Orange 3%
- Yellow 4%
- Green 0.5%

# 5 or 6 Band Tolerance Colour Codes

- Black NA
- Brown 1%
- Red 2%
- Orange 3%
- Yellow 4%
- Green 0.5%
- Blue 0.25%

# 5 or 6 Band Tolerance Colour Codes

- Black NA
- Brown 1%
- Red 2%
- Orange 3%
- Yellow 4%
- Green 0.5%
- Blue 0.25%
- Violet 0.1%

# 5 or 6 Band Tolerance Colour Codes

- Black NA
- Brown 1%
- Red 2%
- Orange 3%
- Yellow 4%
- Green 0.5%
- Blue 0.25%
- Violet 0.1%
- Grey 0.05%

# 5 or 6 Band Tolerance Colour Codes

- Black NA
- Brown 1%
- Red 2%
- Orange 3%
- Yellow 4%
- Green 0.5%
- Blue 0.25%
- Violet 0.1%
- Grey 0.05%
- White NA