

# Re: Proof of Ohms law

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- *From:* Joerg <[notthisjoergsch@xxxxxxxxxxxxxxxxxxxxxxxxxxxx](mailto:notthisjoergsch@xxxxxxxxxxxxxxxxxxxxxxxxxxxx)>
  - *Date:* Fri, 08 Feb 2008 01:06:11 GMT
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John Larkin wrote:

On Wed, 06 Feb 2008 00:35:21 GMT, "Jon Slaughter"  
<[Jon\\_Slaughter@xxxxxxxxxxxxx](mailto:Jon_Slaughter@xxxxxxxxxxxxx)> wrote:

"noone." <[harrytuttle777@xxxxxxx](mailto:harrytuttle777@xxxxxxx)> wrote in message  
[news:foao1t024g6@xxxxxxxxxxxxxxxxxxxxxxxxxxxx](mailto:news:foao1t024g6@xxxxxxxxxxxxxxxxxxxxxxxxxxxx)

Has anyone ever proven Ohms law from first principals?

I mean is there any way to take the laws of electrostatics, and  
from the derive  $E = IR$ ?

Just Curious  
-Thanks

It can be proved from maxwell's equations(and chances are any book on  
electromagnitism will drive it). Also there are a few assumptions that are  
made.

Heres the general idea:

$J = -ne*v$  is the current density for a material with charge moving on average  
with speed  $v$ .

but  $v = - (e/m)E*\tau$

So  $J = g*E$  where  $g$  is called the conductivity. i.e., it depends on the material  
only and not the applied field  $E$ .

Hence there is a relation between the voltage and current(density) and it says  
they are proportional(For the assumption on the average velocity).

If you apply it to a "rod" or "wire" then you get the macroscopic version  
which is ohms law.

## Re: Proof of Ohms law

The main idea here is that applying an electric field produced a motion of charge.. e.g., a velocity of charge and hence  $v$  is a function of  $E$ . But current is just the motion of these charges and hence ultimately  $I$  is a function of  $E$ . For many materials its simply proportionate because  $v$  is proportionate to  $E$ . Its not always the case and of course fails for sufficiently large fields and even depends on frequency(which isn't taken into consideration for this simple analysis). (although the concept can be applied in those cases too by using it as a linear approximation)

That's sort of circular. Maxwell's equations lead to "Ohm's law" only if you assume that carrier velocity is proportional to field strength in certain materials. So you get Ohm's law by assuming Ohm's Law.

Maxwell didn't actually know what a charge carrier is. He died in 1879.

John

Then how about this rationale: Ohm's law has been applied several gazillion times and it always worked. The number of events where it reportedly hasn't jibed were zilch, I assume. Now in the medical world that would be considered bullet-proof clinical evidence.

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Regards, Joerg

<http://www.analogconsultants.com/>

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