

31. Consider an area A , normal to a uniform electric field \vec{E} . The displacement current density is uniform and normal to the area. Its magnitude is given by $J_d = i_d/A$. For this situation

$$i_d = \varepsilon_0 A \frac{dE}{dt} ,$$

so

$$J_d = \frac{1}{A} \varepsilon_0 A \frac{dE}{dt} = \varepsilon_0 \frac{dE}{dt} .$$