

29. The displacement current is given by

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

where  $A$  is the area of a plate and  $E$  is the magnitude of the electric field between the plates. The field between the plates is uniform, so  $E = V/d$ , where  $V$  is the potential difference across the plates and  $d$  is the plate separation. Thus

$$i_d = \frac{\varepsilon_0 A}{d} \frac{dV}{dt} .$$

Now,  $\varepsilon_0 A/d$  is the capacitance  $C$  of a parallel-plate capacitor (not filled with a dielectric), so

$$i_d = C \frac{dV}{dt} .$$