Si Limits

1959 - first Si transistor (II)
1960s - first Power BJT
1976 - first Power MOSFET
1980s - Vertical DMOS (IR)
1987 - Trench MOSFET
1997 - SS MOSFET
1997 - SiC MOSFET

Trench MOSFETs

J. Brown & G. Moxey, "Power MOSFET Basics: Understanding MOSFET Characteristics Associated With The Figure of Merit"
Superjunction MOSFETs

Unipolar Limitations
Charge Coupling

At some low $V_G$, depletion region expands to $W_D \approx W_n \approx W_p$

$E_f = E_x + E_y$

Previous "Ideal" $R_m P = \frac{1}{W_n E_c}$

$R_{on,p} = \frac{W_n}{W_P} E_c$

T. Fujihira, "Theory of Semiconductor Superjunction Devices"