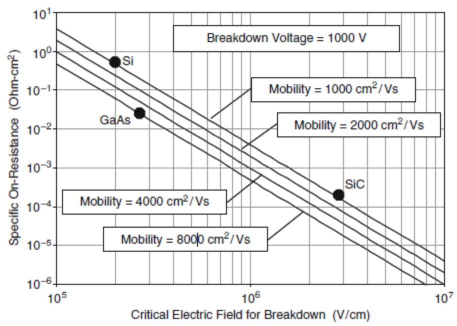
Ideal Specific On-Resistance



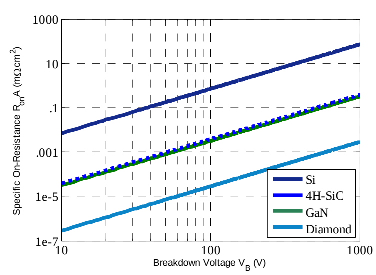
Baliga, B J, "Advanced Power MOSFET Concepts"

WBG Materials

Table 2.1. Physical characteristics of Si and the major WBG semiconductors

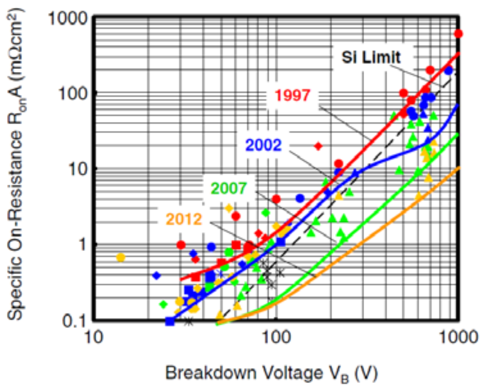
Property	Si	GaAs	6H-SiC	4H-SiC	GaN	Diamond
Bandgap, E_g (eV)	1.12	1.43	3.03	3.26	3.45	5.45
Dielectric constant, $\varepsilon_r{}^a$	11.9	13.1	9.66	10.1	9	5.5
Electric breakdown field, E_c (kV/cm)	300	400	2,500	2,200	2,000	10,000
Electron mobility, μ_n (cm^2/V·s)	1,500	8,500	500 80	1,000	1,250	2,200
Hole mobility, μ_p (cm^2/V·s)	600	400	101	115	850	850
Thermal conductivity, λ (W/cm·K)	1.5	0.46	4.9	4.9	1.3	22
Saturated electron drift velocity, v_{sat} ($\times 10^7$ cm/s)	1	1	2	2	2.2	2.7

[a] $\varepsilon = \varepsilon_r \cdot \varepsilon_o$ where ε_o=8.85×10^{-14} F/cm.



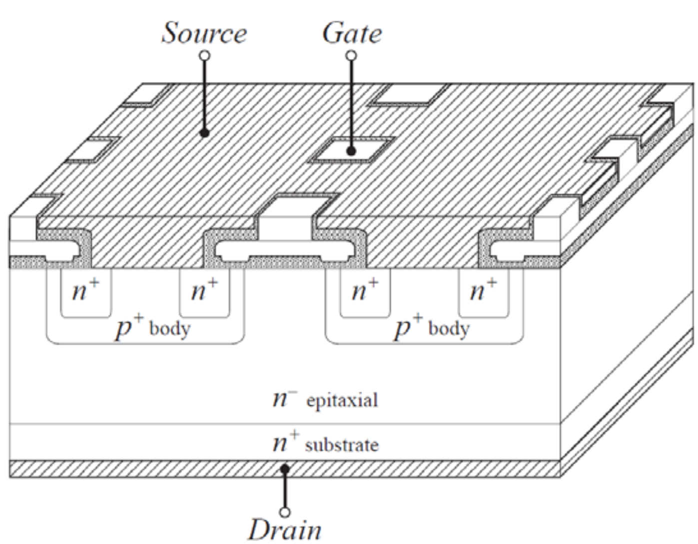
B Ozpineci, L M Tolbert, "Comparison of Wide-Bandgap Semiconductors for Power Electronics Applications"

Si Limits

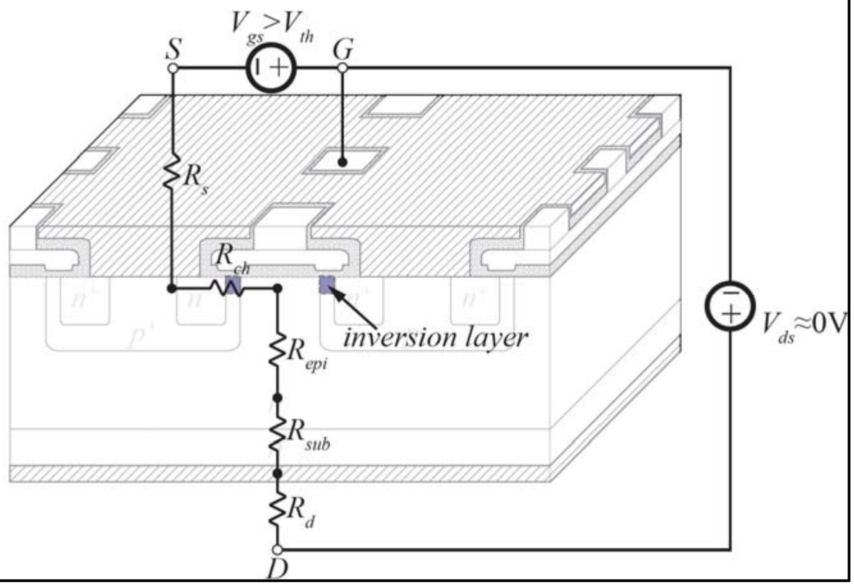


W. Saito, "Power device trends for high-power density operation of power electronics system"

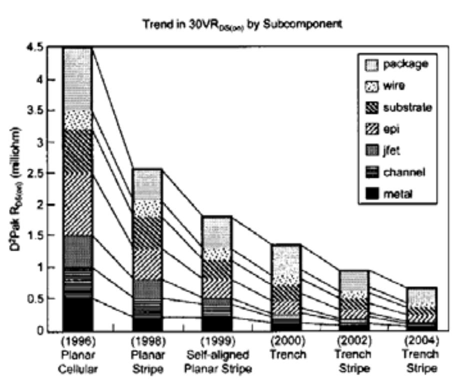
MOSFET Cross Section



MOSFET On-Resistance



Resistance Contributions



A. Lidow er al. “The Semiconductor Roadmap for Power Management in the New Millennium

Resistance Contributions Vs. Voltage

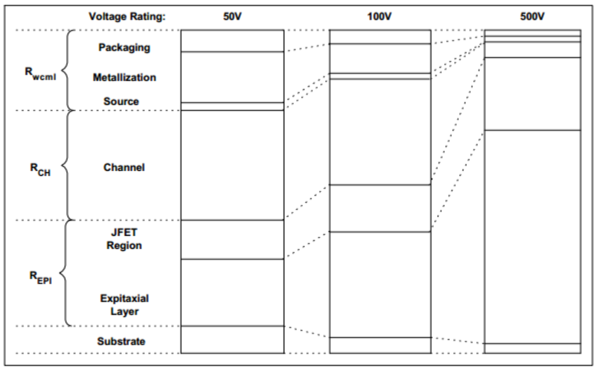
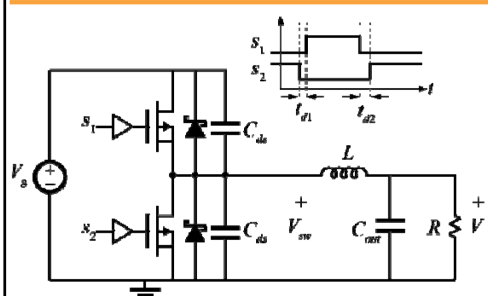


Figure 9. Relative Contributions to $R_{DS(on)}$ With Different Voltage Ratings.

V. Barkhordarian et al. "Power MOSFET Basics"

Buck Converter Example



Ideal On-Resistance