

























Hot Carriers

- Electric fields across channel impart high energies to some carriers
 - These "hot" carriers may be blasted into the gate oxide where they become trapped
 - Accumulation of charge in oxide causes shift in $V_{\rm t}$ over time
 - Eventually V_{t} shifts too far for devices to operate correctly
- Choose V_{DD} to achieve reasonable product lifetime
 - Worst problems for inverters and NORs with slow input rise time and long propagation delays

D. Z. Pan

18. Circuit Design Pitfalls 15







 Use ESD protection structures where chip meets real world

D. Z. Pan 18. Circuit Design Pitfalls 18



D. Z. Pan

18. Circuit Design Pitfalls 19



D. Z. Pan

18. Circuit Design Pitfalls 20