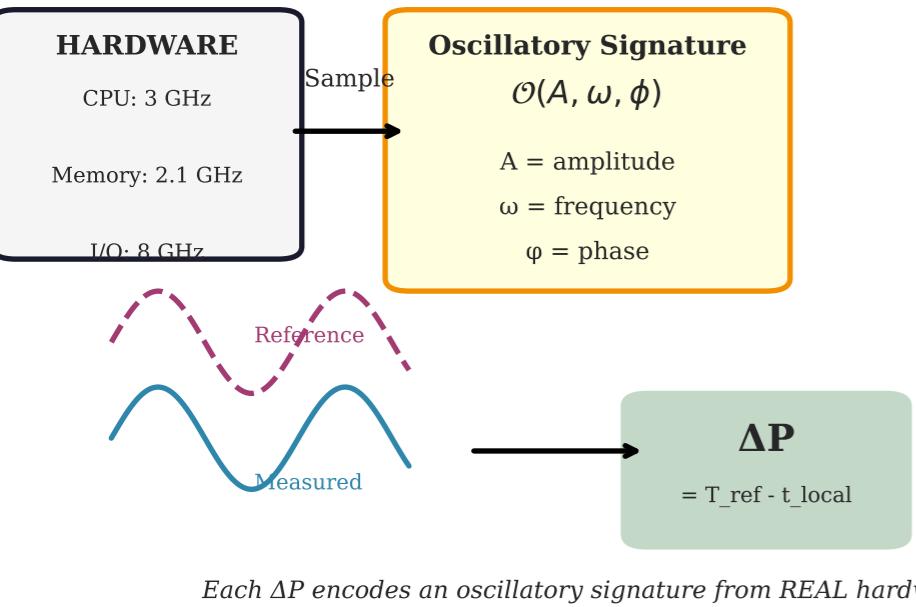


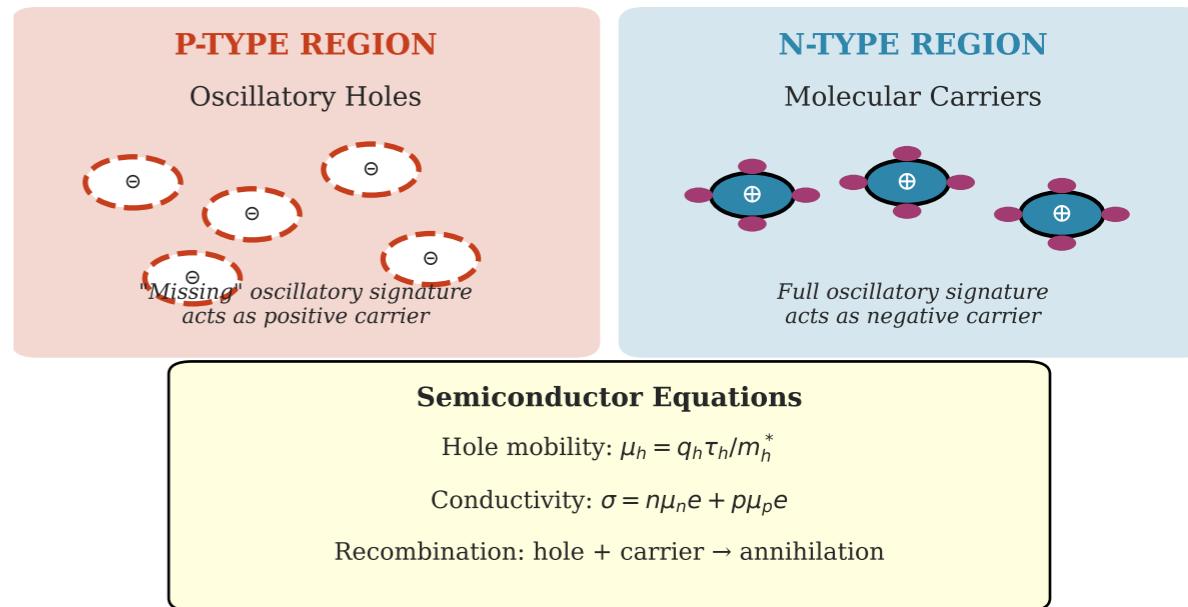
Hardware-Based Biological Semiconductors & Transistors

Oscillatory Holes → P-N Junctions → BMD Transistors → Logic Gates

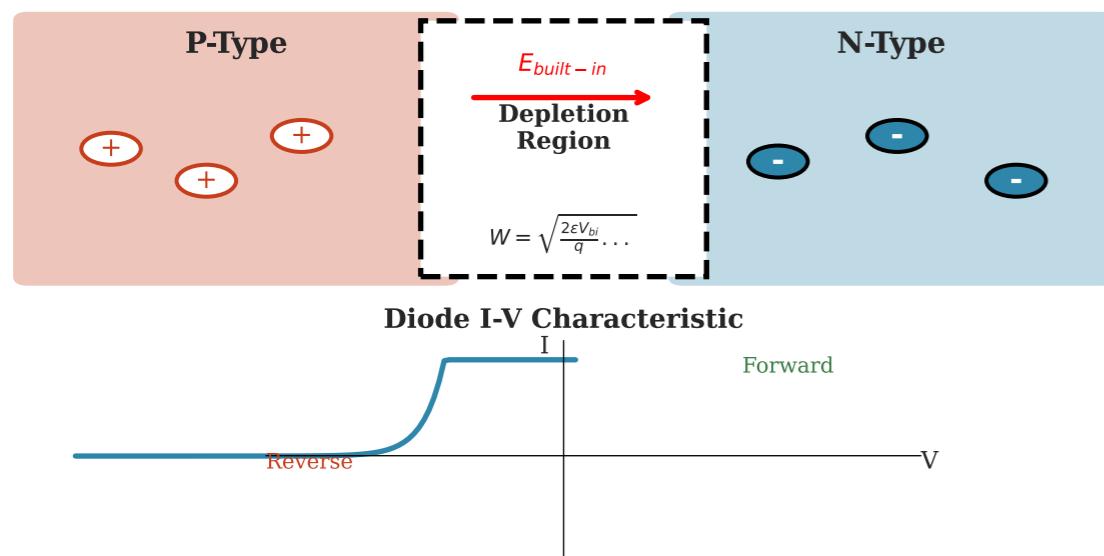
A. Hardware → Oscillatory Signatures



B. P-Type Holes & N-Type Carriers

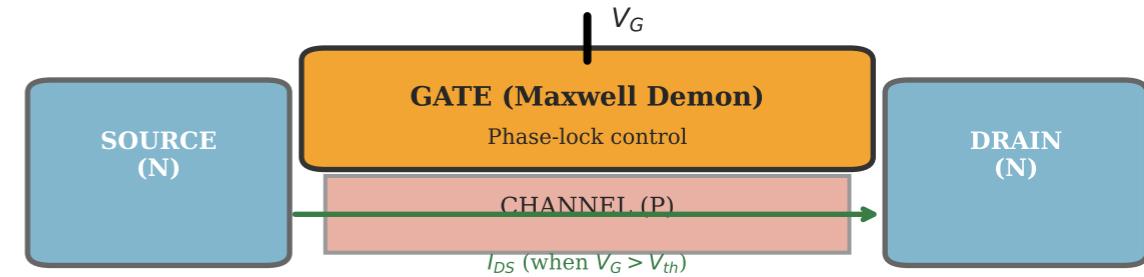


C. P-N Junction Formation



D. Biological Maxwell Demon Transistor

Phase-Lock Gated Ion Channel Transistor

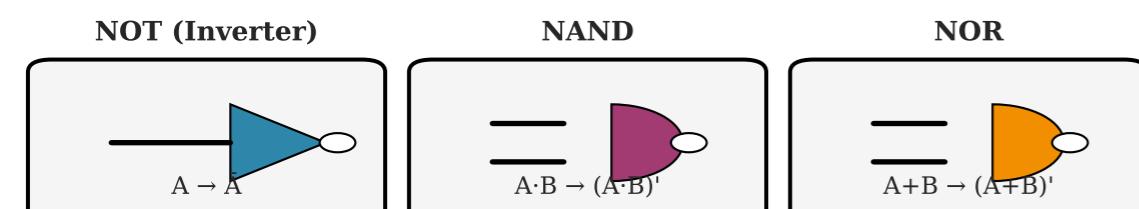


Biological Transistor Properties

- Clock frequency: 758 Hz (ATP-driven)
- Coherence time: 10 ms (phase-locked)
- Gate operation: < 100 μ s
- Fidelity: > 85%
- Energy: 446 \times Landauer limit per operation

E. Logic Gates from Transistors

Logic Gates from BMD Transistors

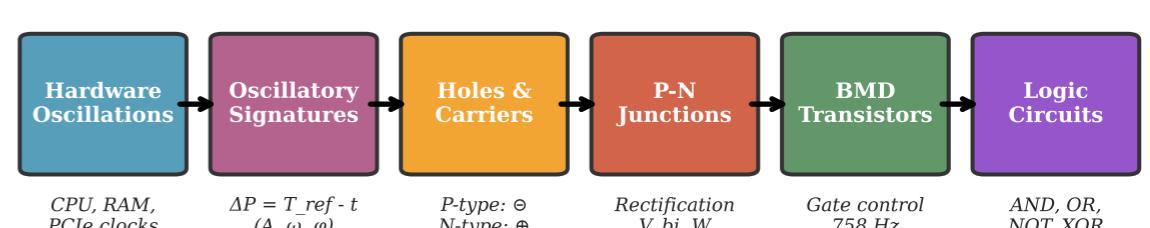


Quantum Gates (Phase-Lock Implementation)



Fidelity > 85% | Operation < 100 μ s | Landauer-optimal

F. Complete Hardware → Logic Pipeline



KEY INSIGHT: Hardware Grounding

The semiconductor substrate is constructed from REAL hardware oscillations.

- CPU timing jitter → Oscillatory holes (P-type carriers)
- Memory latency variations → Molecular carriers (N-type)
- Phase-lock networks → Transistor gates (Maxwell demons)