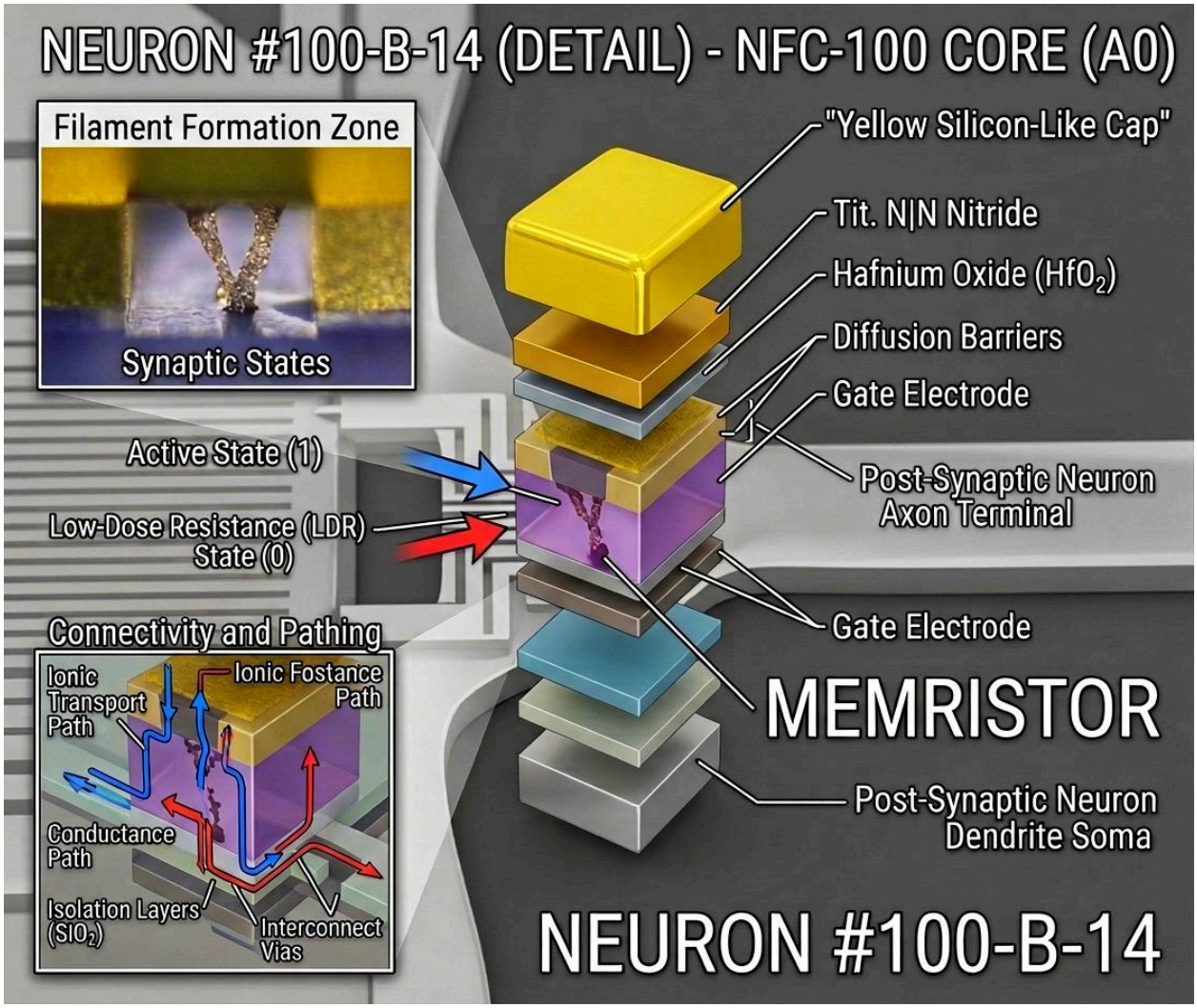
Neuron #100-B-14 Technical Summary



The **NFC-100 Core (A0)** is a neuromorphic hardware component designed to intersect biological synaptic function with semiconductor engineering. The central focus is the **Synaptic Junction**, which bridges the gap between two biological-like electronic components:

1. **Pre-Synaptic Axon Terminal:** Initiates the input signal.
2. **Post-Synaptic Neuron Dendrite Soma:** Receives and processes the complete signal output.

The structure is topped by a yellow, silicon-like cap, supported by diffusion barriers.

Memristor Element #100-B-14

The core logic unit is the memristor element, a vertically layered stack that mimics a biological synapse. Data is stored through physical changes within a **Hafnium Oxide (HfO_2) switching medium** that modulate electrical resistance.

Physical Composition:

- **Cap:** A yellow, silicon-like cap.
- **Layers:** Titanium Nitride ($Tit. N|N N_2$) and Hafnium Oxide (HfO_2).
- **Containers:** These layers are contained by diffusion barriers.
- **Gate Electrode:** The stack is positioned above a gate electrode.
- **Substrate & Matrix:** The entire assembly operates on a 30 GHz substrate built on a Carbon-Corundum matrix.
- **Isolation:** The structure is supported by SiO_2 isolation layers to ensure electrical stability.

Functional Mechanism: Data is stored through two primary synaptic states:

- **Active State (1):** This state represents the conductant state of the synapse, where a conductive path or **"filament"** is fully formed within the Hafnium Oxide medium. This low-resistance pathway permits electrical current flow, signaling a binary "1".
- **Low-Dose Resistance (LDR) State (0):** This state occurs when the conductive filament is partially or fully broken, signaling a non-conductant state. This high-resistance environment blocks current flow, representing a binary "0".

Pathing and Connectivity: The unit utilizes a sophisticated dual-pathway system:

- **Ionic Transport Path:** Crucial for the ion movement that facilitates state switching. technical diagrams often show blue and red lines to illustrate the direction of this flow.
- **Conductance Path:** Ensures electrical conductivity by routing signals throughIsolation Layers (SiO_2) and interconnect vias to maintain signal integrity across the larger network.

For more information, visit: https://palaia.com