# Restoring the Signal: How the Occam Process Redefines Interconnect Integrity in High-Speed Electronics

Signal integrity has become a first-order design constraint in modern electronics. As edge rates shrink into the tens of picoseconds and channel bandwidths extend into multi-gigahertz regimes, interconnect parasitics—not silicon—often dominate system performance. The Occam Process fundamentally alters the interconnect architecture of an assembly, delivering measurable signal integrity advantages over conventional solder-based PCB construction.

## 1. Elimination of Solder-Induced Parasitics

Traditional surface-mount assembly relies on solder joints that introduce intermetallic layers. Each joint adds parasitic inductance, capacitance, and nonlinear resistance. At high frequencies, these discontinuities create impedance mismatches, reflections, and mode conversion.

The Occam Process removes solder joints from the signal path. Components are embedded and interconnected through plated copper structures formed after precise alignment. The result is a metallurgically homogeneous copper interconnect with tightly controlled cross-sectional geometry.

Solder joints require the mounting pad to be extended to create a reliable fillet. The pad extensions add capacitance to the device’s inputs/outputs. Occam eliminates these extensions/capacitance by not requiring soldering pad extensions.

## 2. Shortened Electrical Path Length

In conventional multilayer PCBs, signals travel from component terminations through solder joints, pads, vias, and traces before reaching the target device. Each transition contributes impedance discontinuities and propagation delay.

The Occam Process collapses this hierarchy. Embedded components and plated additive copper formation enable dramatically shorter interconnect distances. Reduced path length lowers propagation delay, minimizes attenuation, and improves timing margins—critical for DDR, SerDes, and RF front-end architectures.

## 3. Improved Impedance Control

Precise impedance control depends on consistent conductor geometry and dielectric spacing.

Because the Occam Process defines interconnect geometry through lithographically controlled copper deposition, trace dimensions and dielectric thicknesses are significantly more uniform. The absence of solder fillets eliminates local impedance spikes. Designers can achieve tighter impedance tolerances across the entire signal path, reducing the need for overdesign and excessive equalization.

### 4. Reduced Stub and Via Discontinuities

Conventional PCB architectures often rely on through-holes or blind/buried vias, which introduce stubs that degrade high-speed performance. Back-drilling mitigates this effect but adds cost and process variability.

Occam’s build-up methodology allows interconnects to be formed directly between component terminations while minimizing routing layers. The reduction—or elimination—of via stubs decreases resonant behavior and improves eye diagram openness at high data rates.

### 5. Superior Power Distribution Integrity

Signal integrity is inseparable from power integrity. Conventional assemblies suffer from distributed inductance between decoupling capacitors and active devices due to solder joint height and planar separation.

With embedded components and ultra-short copper interconnects, the Occam Process significantly reduces loop inductance in power distribution networks. Lower Power Distribution Network (PDN) impedance suppresses simultaneous switching noise (SSN) and ground bounce, stabilizing reference planes and preserving signal fidelity.

### 6. Enhanced Thermal-Mechanical Stability

Solder joints are mechanically and thermally dynamic structures. Micro-cracking, intermetallic growth, and coefficient-of-thermal-expansion (CTE) mismatch introduce resistance drift and impedance variability over time.

Copper-formed interconnects in the Occam Process exhibit greater mechanical uniformity and reduced long-term variability. This stability translates to consistent impedance characteristics across product life—particularly important in defense, aerospace, and high-reliability applications.

### 7. Improved High-Frequency Performance

At microwave and millimeter-wave frequencies, even minor geometric discontinuities become significant radiators or reflectors. The smoother current transition achieved through copper-to-copper interconnect reduces current crowding and localized field concentration. This lowers conductor loss and improves signal-to-noise ratio.

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In summary, the Occam Process enhances signal integrity by simplifying and shortening the electrical path, eliminating solder-induced parasitics, tightening impedance control, and improving power distribution stability. As systems push toward higher speeds and higher frequencies, these structural advantages shift performance limitations away from interconnect artifacts and back to where they belong: device physics.