**Design Calculations & Nominal Component Selection for Buck Converter Using SiC431**

This buck converter is designed to deliver a stable and efficient 3.3 V power rail suitable for powering Intel® Xeon® processors, which require precise and reliable voltage supplies for optimal operation. The wide input voltage range from 4.5 V to 24 V allows compatibility with various power sources commonly found in server and enterprise environments where Xeon processors are deployed. Supporting a high load current of up to 20 A ensures the converter can meet the substantial power demands of multi-core Xeon CPUs during peak processing loads. The 500 kHz switching frequency balances efficiency and output ripple, aligning with the stringent voltage regulation and noise immunity requirements typical of Intel® Xeon® voltage regulator modules (VRMs), thereby ensuring processor stability, performance, and longevity in demanding applications.

**1. Design Parameters**

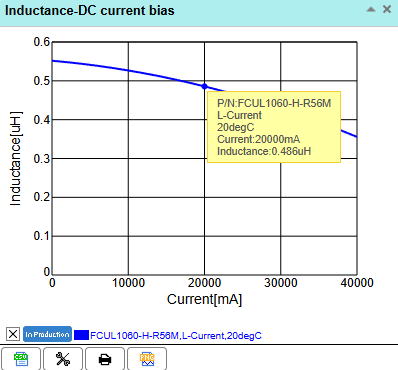
**2. Duty Cycle**

**3. Inductor Value**

**Given:**

* V
* *(used only for % ripple)*
* Duty cycle

**Ripple Current Formula:**

**Ripple Percentage:**

Reducing inductance from **560 nH → 484 nH** causes:

* **Ripple current to increase** from **3.86 A → 4.46 A**
* **% ripple** from **19.3% → 22.3%**

This is still **within acceptable range**, but we will:

* Need slightly **more output capacitance**
* See slightly **higher voltage ripple**
* Benefit from **faster transient response**

|  |  |  |
| --- | --- | --- |
| Inductor | Ripple Current (ΔIL) | % of 20 A |
| 560 nH | 3.86 A | 19.3% |
| 484 nH | 4.46 A | 22.3% |

**Input Capacitor RMS Current**

**Minimum Input Capacitance**

**Peak Inductor Current**

**Output Cap for Load Release (energy-based method)**