

Power Considerations for 400GAUI-4

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Supporters

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Caveats and Disclaimers

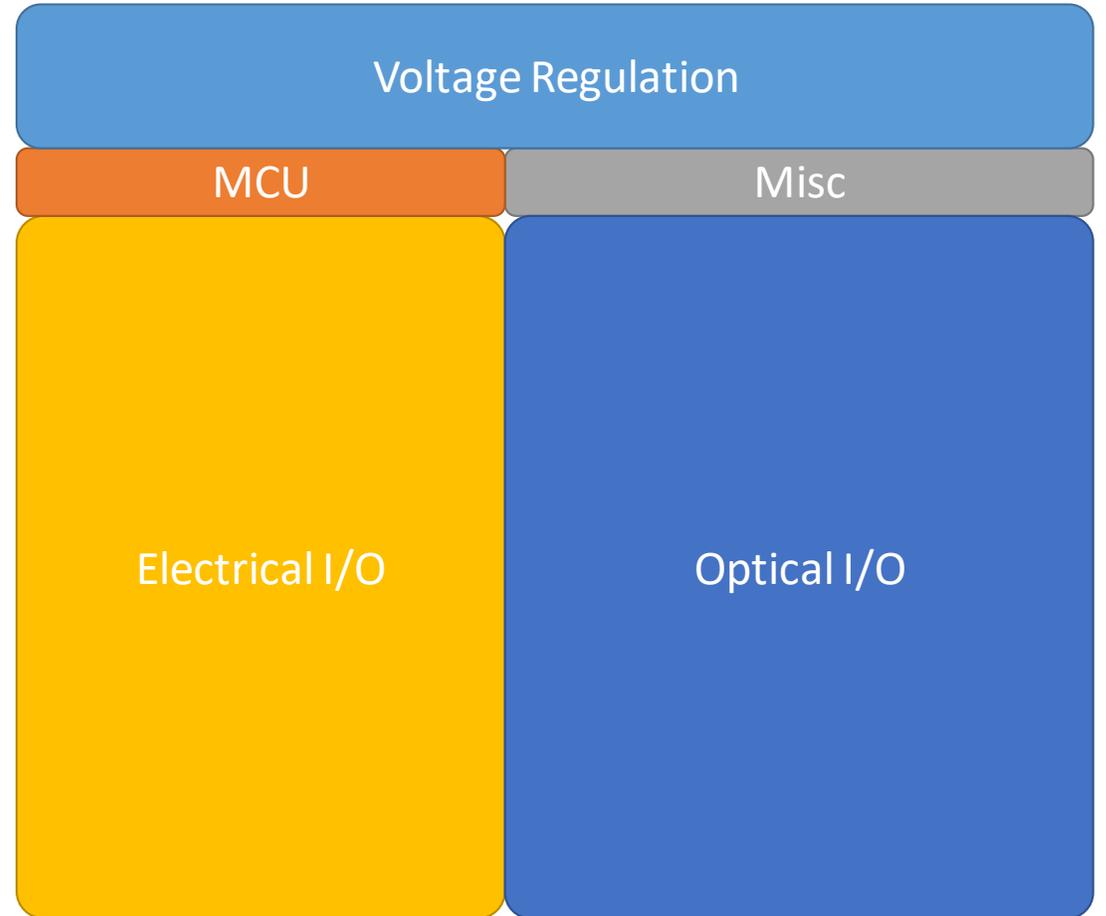
The figures contained within are examples based on reasonably understood industry abilities/targets. They do not represent any specific vendors product or products.

Power Considerations for 400GAUI-4

- Statements have been made indicating a 2x400G (8x100G) optical module with 100G/lane electrical interfaces will be desired in the market
 - Instead of a 1x100G
- Assuming that is the case it is reasonable to expect that current eight lane module form factors will be targeted for such products:
 - OSFP and QSFP-DD
- These form factors have certain power/thermal constraints, which may be challenging even for some 1x400G optical modules
 - Max demonstrated power of up to 15 W for a DC environment

Transceiver Functions (High Level)

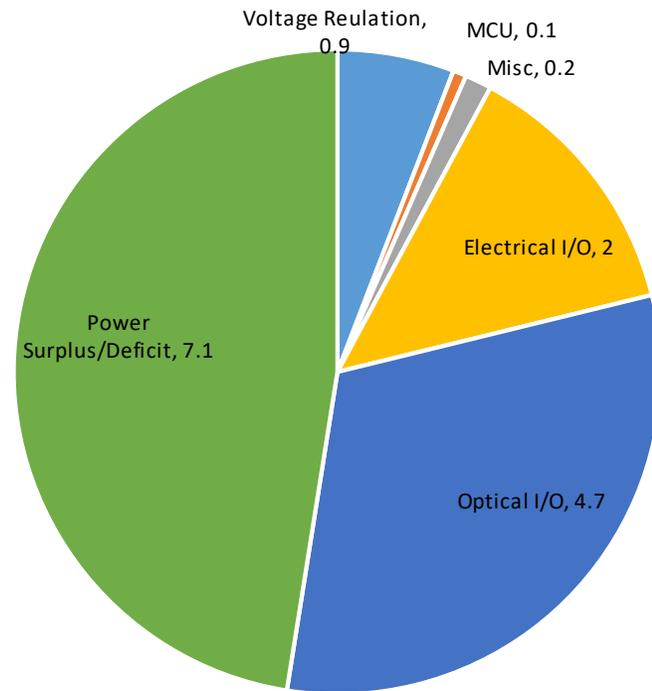
- **Electrical I/O**: 400GAUI-8/4
- Misc: Monitoring/Other
- **Optical I/O**: 400GBase-DR4
- **MCU**: Module control and Interface
- **Voltage Regulation**



Power surplus/deficit measured against 15W module max

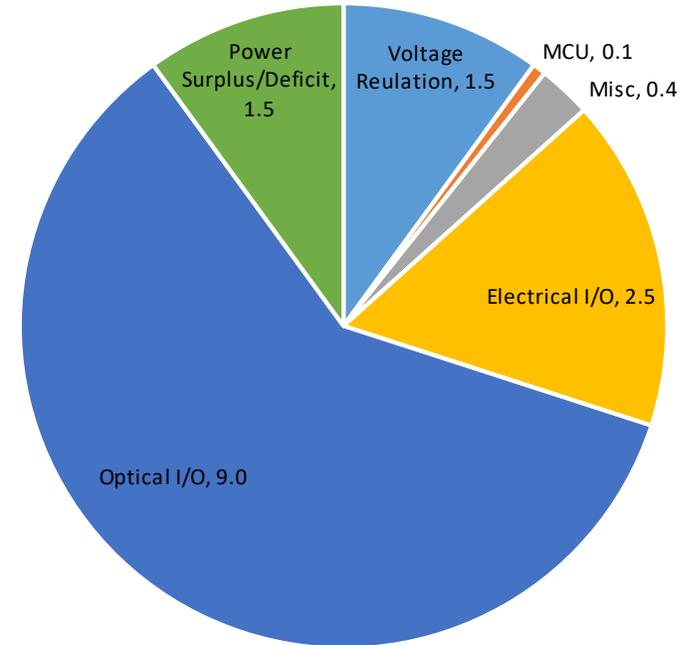
1x400GBase DR4: Gen 1

Lowest Max Power ~ 7.9 W



Power Surplus ~ 7.1 W

Highest Max Power ~ 13.5 W



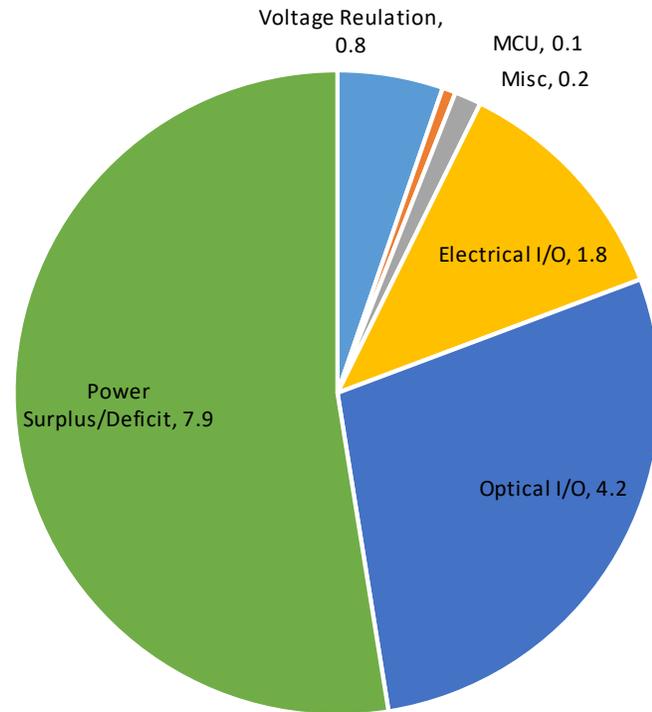
Power Surplus ~ 1.5 W

1x400G: From Gen 1 to Gen 2

- Caveat: a second generation of 400G transceivers may not be realized by any/all module vendors due to increased development costs of optical modules
- For those that do multiple generations power reductions assumed to range from 10-20%:
 - 10% for low power modules
 - 20% for high power modules

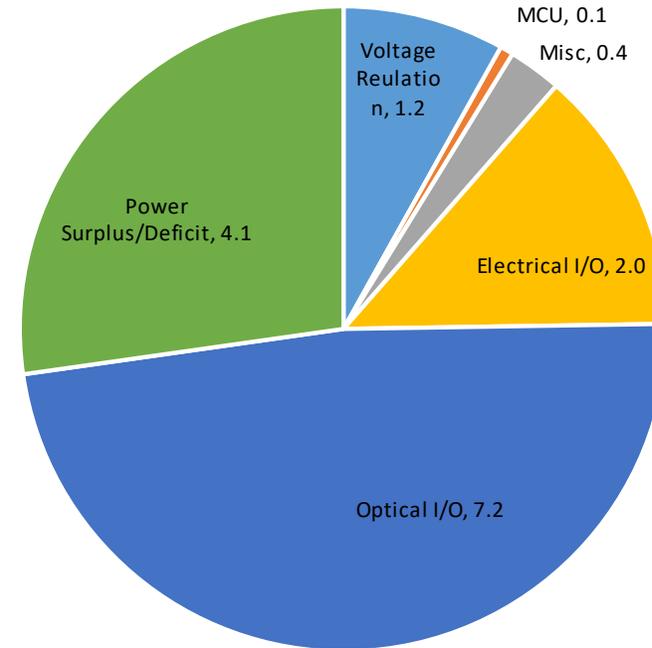
1x400GBase DR4: Gen 2

Lowest Max Power ~ 7.1 W



Power Surplus ~ 7.9 W

Highest Max Power ~ 10.9 W



Power Surplus ~ 4.1 W

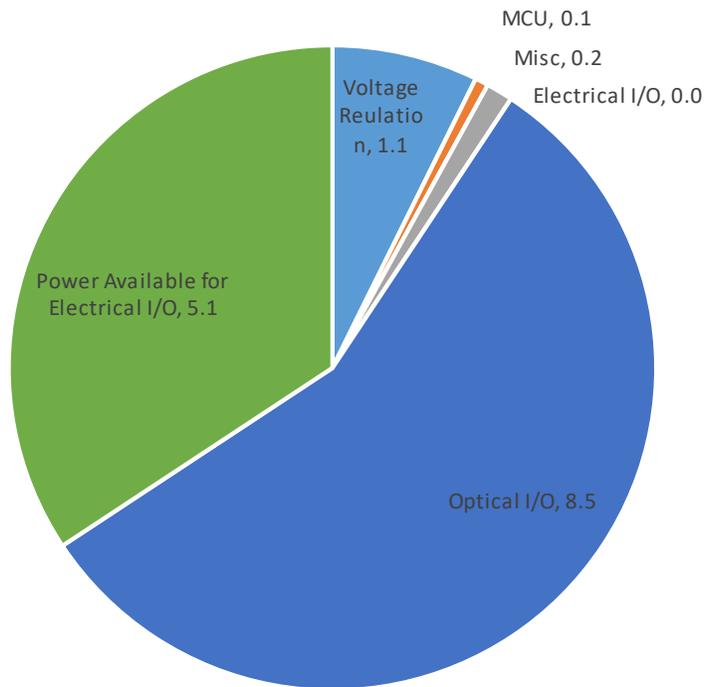
From 1x400G to 2x400G

- Assuming “Gen2” 1x400G solutions as a baseline, the following changes expected:
 - Replace 400GAUI-8 with 400GAUI-4
 - Doubling of module density
- Following slide looks at the power breakdown excluding the electrical I/O.

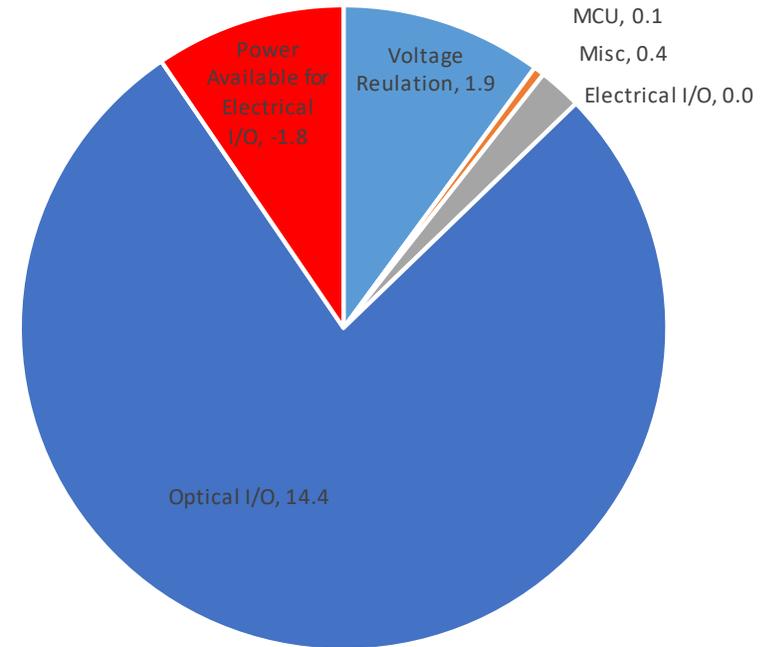
2x400GBase DR4: Gen 1 excluding Electrical I/O

Lowest Max Power (ex. electrical I/O) ~ 9.9 W

Highest Max Power (ex. electrical I/O) ~ **16.8 W**



Power Available for Electrical I/O ~ 5.1 W



Power Available for Electrical I/O ~ -1.8 W

2x400G and 400GAUI-4

- In the best case there may be up to 5.1 W available for 2x400GAUI-4 electrical I/O
 - Assuming 15W max module power is acceptable
 - Accounting for regulator efficiencies this is approximately 4.5 W at the chipset level
 - 2.25 W per 400G, 565 mW per 100G
- In the worst case there is no power available for electrical I/O
 - Power deficit of -1.5 W in the worst case
- A “nominal” case may be somewhere in between
 - Approximately 200 mW available per 100G

Additional Thoughts on Power

- Actual modules may not be able to consume as much power as thermal demonstrators
 - More concentrated power consumption can reduce cooling efficacy
 - Thermal demonstrators often have thermal resistors distributed inside of the module
 - Actual modules usually have power concentrated in a few chipsets
 - Functional limit (for air cooled solutions) likely $< 14W$
- Are other cooling options available that may increase the 15W limit?
 - Liquid cooling has been mentioned before

Summary

- Assuming 2x400G solutions are desired then **very little power is available** for the 400GAUI-4 electrical I/O
 - If only 1x400G solutions are desired then things may look quite different
- Taking all reasonable steps to **minimize module side power consumption** in a 400GAUI-4 electrical I/O standard would increase the odds of 2x400G modules being possible.