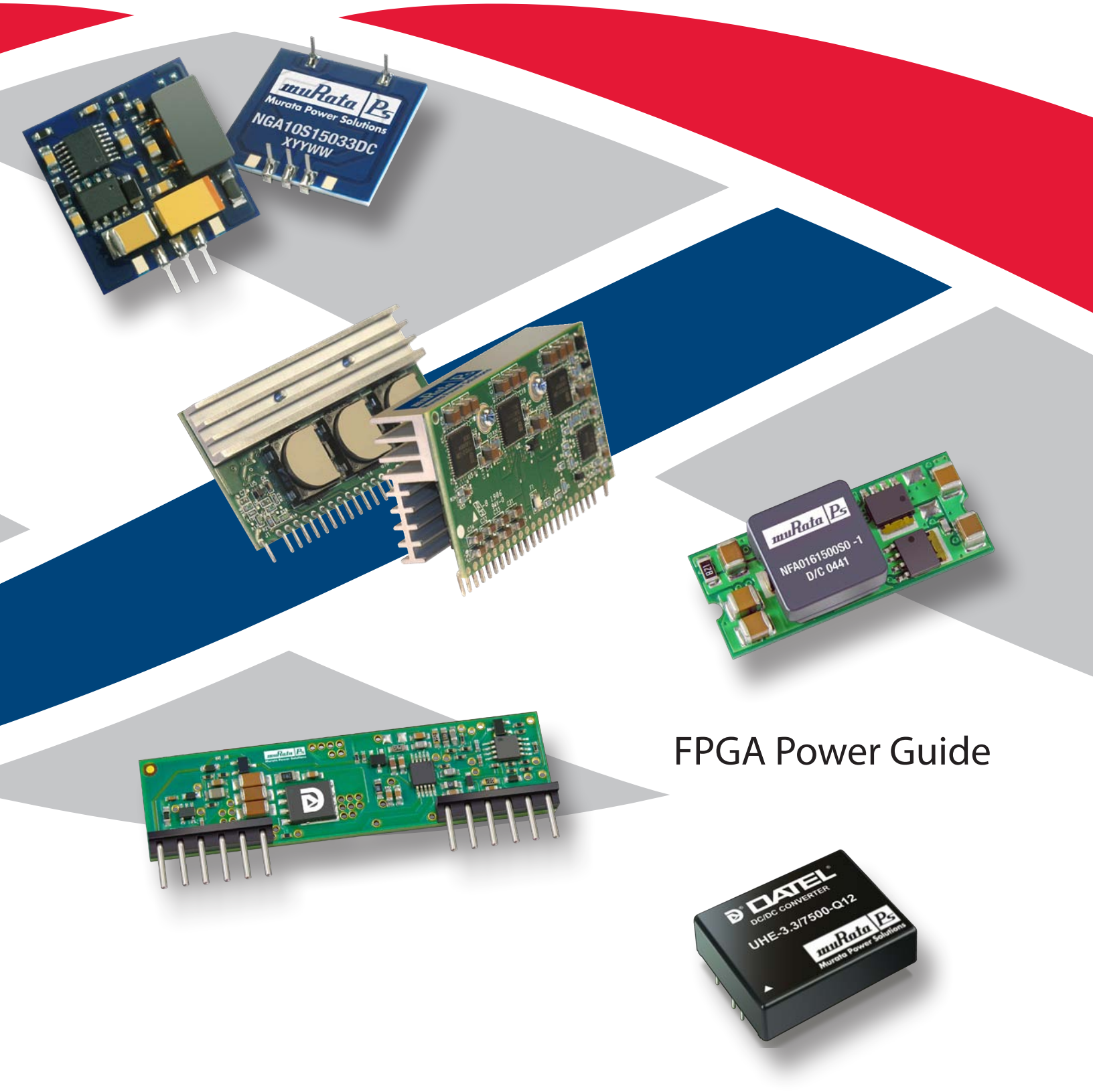
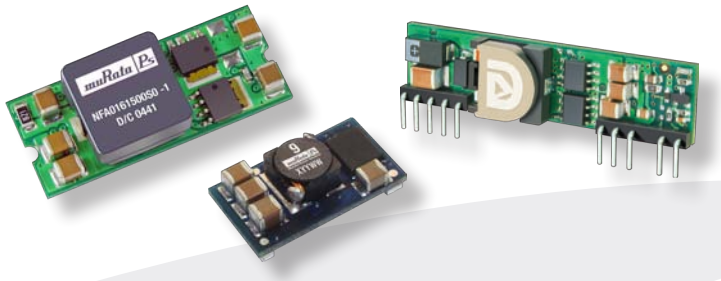


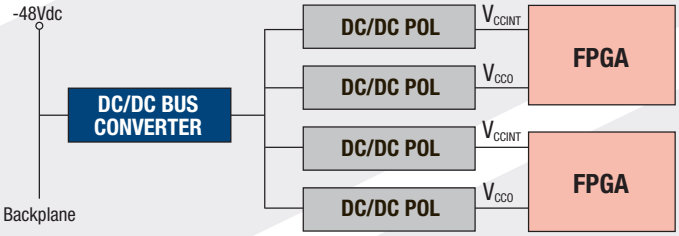
FPGA Power Guide

Powering innovation...

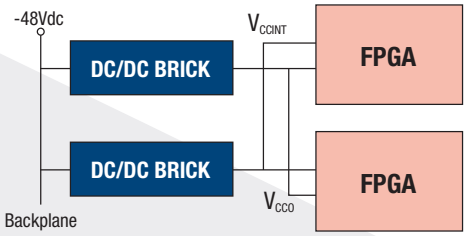


Murata Power Solutions' broad selection of DC/DC converters is well suited to powering modern FPGA products. A combination of distributed power and intermediate bus architecture products can effectively be deployed to meet the power requirements of leading FPGA products. These products include standard "brick" isolated converters as well as intermediate bus converters and non-isolated point-of-load (POL) converters. Examples of distributed and intermediate bus power architectures for powering FPGAs are provided here.

Intermediate Bus Power Solution for FPGA



Distributed Power Solution for FPGA



Steady State Power Requirements for FPGA Families in Typical Applications

Altera	Stratix II	Stratix	Cyclone II	Cyclone
V_{CCINT} (Core)	1.2V ± 5% @ 1A to 6A	1.5V ± 5% @ 1A to 10A	1.2V ± 5% @ 500mA to 5A	1.5V ± 5% @ 500mA to 5A
V_{CCO} (Vo)	3.3V, 2.5V, 1.8V and/or 1.5V ± 5% @ 500mA to 6A	3.3V, 2.5V, 1.8V and/or 1.5V ± 5% @ 500mA to 6A	3.3V, 2.5V, 1.8V and/or 1.5V ± 5% @ 500mA to 6A	3.3V, 2.5V, 1.8V and/or 1.5V ± 5% @ 500mA to 6A
V_{CCPD} (Aux)	3.3V ± 5% @ 300mA	–	–	–

Xilinx	Virtex-5	Virtex-4FX, SX, LX	Virtex-II Pro	Virtex-II	Virtex-E	Virtex	Spartan-3, -3E, -3L	Spartan-IIE	Spartan-II
V_{CCINT} (Core)	1V ± 5% @ 200mA to 5A	1.2V ± 5% @ 200mA to 5A	1.5V ± 5% @ 200mA to 12A	1.5V ± 5% @ 200mA to 12A	1.8V ± 5% @ 200mA to 7A	2.5V ± 5% @ 200mA to 7A	1.2V ± 5% @ 200mA to 5A	1.8V ± 5% @ 200mA to 3A	2.5V ± 5% @ 200mA to 2A
V_{CCO} (Vo)	3.3V, 2.5V, 1.8V, 1.5V and/or 1.2V ± 5% @ 50mA to 4A	3.3V, 2.5V, 1.8V, 1.5V and/or 1.2V ± 5% @ 50mA to 4A	3.3V, 2.5V, 1.8V and/or 1.5V ± 5% @ 50mA to 5A	3.3V, 2.5V, 1.8V and/or 1.5V ± 5% @ 50mA to 5A	3.3V, 2.5V, 1.8V and/or 1.5V ± 5% @ 500mA to 5A	3.3V, 2.5V and/or 1.5V ± 5% @ 50mA to 5 A	3.3V, 3.0V, 2.5V, 1.8V, 1.5V and/or 1.2V ± 5% @ 50mA to 4A	3.3V, 2.5V, 1.8V and/or 1.5V ± 5% @ 50mA to 750mA	3.3V, 2.5V and/or 1.5V @ 50mA to 500mA
V_{CCAUX} (Aux)	2.5V ± 5% @ 300mA	2.5V ± 5% @ 300mA	2.5V ± 5% @ 300mA	3.3V ± 5% @ 300mA	–	–	2.5V ± 5% @ 300mA	–	–

Some models have reduced output currents for the higher output voltage.

For more precise power requirements for specific FPGA applications please refer to the Xilinx and Altera Power Estimators available at www.xilinx.com/power and www.altera.com/power, respectively.

1 Safety Critical Component means any component whose failure to perform could cause the failure of, or affect the operation of a Life Support Device.

2 Life Support Device means any device, system or ancillary equipment intended for implant into the body or used in relation to supporting or sustaining life.

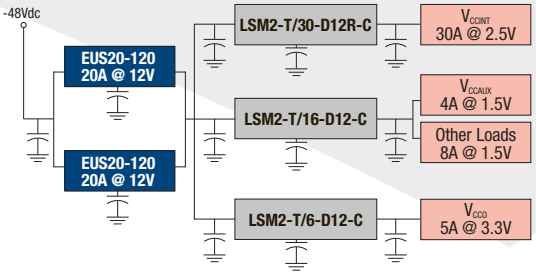
Modular vs Discrete Power Solutions for FPGAs

Many vendors currently offer power solutions for FPGAs using discrete based power solutions. While these solutions may seem attractive initially from a pure cost assessment, modular solutions offer many key advantages: **minimal design resources; reduced parts count and board real estate; multiple sourcing.**

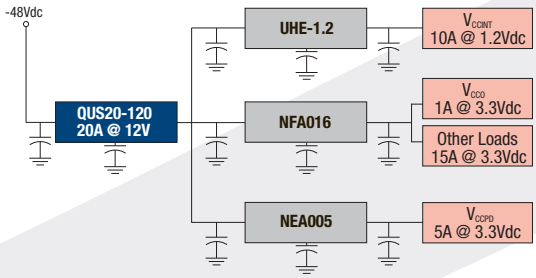
Intermediate Bus Power Solutions

- Modular DC/DC converter solution requires minimal design resources and is suitable for powering one or more FPGAs
- Highly efficient solution with POL conversion efficiencies approaching 93%
- Space efficient SMT packages designed for use in low-cost automated manufacturing environments
- Reliable power conversion solution with typical converter MTTF in excess of 1 million hours per Telcordia standards

Xilinx Spartan-3 Application Example, 10A Core Voltage (V_{CCINT})



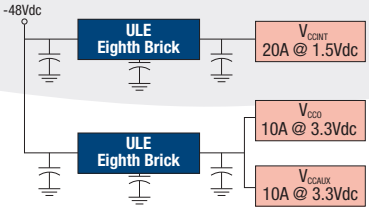
Altera Stratix II Application Example, 10A Core Voltage (V_{CCINT})



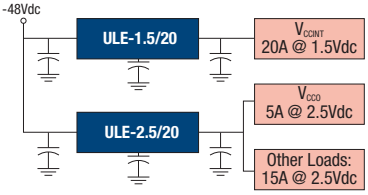
Distributed Power Solutions

- Modular DC/DC converter solution suitable for powering one or more FPGAs from standard telecomm -48Vdc bus
- Low profile, industry standard open frame converters with conversion efficiencies approaching 90%
- Space efficient, high power density power conversion solution available in both through hole and SMT packaging
- Reliable power conversion solution with typical converter MTTF in excess of 1 million hours per Telcordia standards

Xilinx Virtex-II Application Example, 40A Core Voltage (V_{CCINT})



Altera Cyclone Application Example, 20A Core Voltage (V_{CCINT})



Murata Power Solutions DC/DC Converter Modules Reduce System Parts Count and Simplify Solution Design…

Product	Description	Power (W)	Input Voltage (Vdc)	Output Voltage(s) (Vdc)	Output Current (A)
Isolated Converters					
ULQ	Single Output, Quarter Brick, Through Hole/Surface Mount	66	18-36 & 36-75	1.2-12	25
ULE	Single Output, Eighth Brick, Through Hole/Surface Mount	60	9-18, 18-36, & 36-75	1.2-24	30
UHP	Single Output, Half Brick, Through Hole	148	36-75	1.5, 1.8, 2.5, 3.3	60
A Series 7-15W	Single Output, 1" x 2", Through Hole	15	10-18, 18-36 & 36-75	1.2, 1.5, 1.8, 2.5, 3.3, 5.0, 12, 15	10
UHE 12-30W	Single Output, 1.6" x 2", Through Hole	10	9-18, 9-36, & 36-75	1.2, 1.5, 1.8, 2.5, 3.3, 5.0, 12, 15	10
Q-Class	Single Output, Quarter Brick Single Board, PTH	144	36-75	1.2, 1.5, 1.8, 2.5, 3.3, 12	55
UWR 7-15W	1" x 2", Through Hole	15	10-8, 18-36, & 36-75	1.2-15	6
HPH	70A Half Brick	350	36-75	1-5	70
UVQ	Low-Profile Quarter Brick	125	18-36 & 36-75	1.2-48	40
UQQ	Wide Input Quarter Brick	105	9-36 & 18-75	3.3-15	25
UCQ	Low-Cost Quarter Brick	115	18-36 & 36-75	3.3 & 5	35
Bus Converters					
EUS15-120	Single Output Eighth Brick, Pth	180	36V – 55V	12	15
EUS20-120	Single Output Eighth Brick, Pth	240	36V – 55V	12	20
QUS20-120	Single Output Quarter Brick, Pth	240	36V – 55V	12	20
Non-Isolated (POL) Converters					
NGA	Single Adjustable and Fixed Output, SIP/DIP	10	4.75-28	1.8, 2.5, 3.3, 5.0	2
LSM/LSN-10A	Single Fixed Output, SMT/SIP	50	3.0-3.6, 4.5-5.0, 10.8-13.2	1.0, 1.2, 1.5, 1.8, 2.5, 3.3, 5.0	10
LSM/LSN-16A	Single Adjustable and Fixed Output, SMT/SIP	50	3.0-5.5 & 10-14	0.75-5.0	16
LSM/LSN2	Adjustable Output SMT/SIP	52	2.4-5.5 8.3-14	0.75-5	6, 10, 16
LSN2-T/22	Adjustable Output SMT/SIP 22A	112	8.3-14	0.8-5	22
LSN2-T30	Adjustable Output SMT/SIP 30A	150	6-14	0.8-5	30
LEN	Single Output, Eighth Brick, Through Hole/SMT	125	10.2-13.8	0.8, 1.0, 1.2, 1.5, 1.8, 2.5, 3.3, 5.0	28
HEN	Single Output, Eighth Brick, Through Hole/SMT, High di/dt	125	10.2-13.8	0.8, 1.0, 1.2, 1.5, 1.8, 2.5, 3.3, 5.0	25
LQN	Single Output, Quarter Brick, Through Hole/SMT	225	10.2-13.8	0.8, 1.0, 1.2, 1.5, 1.8, 2.5, 3.3, 5.0	50
VCN60	Single Adjustable Output, Through Hole, Vertical Mount	120	10.2-13.2	0.6-3.5	60
VCN70		140	10.2-13.2	0.6-3.5	70
NCA005	Single Adjustable Output, SMT/SIP	16.5	3.0V-5.5V	0.75-3.3	5
NCA015		49.5	3.0V-5.5V	0.75-3.3	15
NEA005		25	8.3V-14V	0.75-5.0	5
NEF010	Single Fixed Output, SMT/SIP	50	8.3V-14V	1.0, 1.2, 1.5, 1.8, 2.0, 2.5, 3.3, 5.0	10
NEA010	Single Adjustable Output, SMT/SIP	50	8.3V-14V	0.75-5.0	10
NEA016		80	8.3V-14V	0.75-5.0	16
NFA010		50	6.0V-14V	0.75-5.0	10
NFA016		80	6.0V-14V	0.75-5.0	16
NFA020		100	6.0V-14V	0.75-5.0	20

Design Considerations

- Core and I/O power consumption are design and application dependent. For more precise power requirements for specific FPGA applications please refer to the Xilinx and Altera Power Estimators available at www .xilinx.com/power and www.altera.com/power, respectively.
- Bulk and/or bypass capacitors will be required between the input supply and DC/DC converters depending on the placement of the input supply relative to the converters. Consult FPGA manufacturers datasheets to ensure adequate bulk and bypass capacitors are used.
- Start-up profile requirements vary by FPGA families and manufacturers; review FPGA device specifications for design considerations such as ramp-up and inrush current.

Filtering

Our extensive range of inductors has been specifically designed to operate at the high current levels required by FPGA applications. For technical details and full product datasheets, or to request a copy of our Magnetics data book, visit us at www.murata-ps.com/magnetics.

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