

REFERENCE DESIGN 5481 INCLUDES: ✓Tested Circuit ✓Schematic ✓BOM ✓Description

Virtex-6 FPGA GTX and Spartan-6 FPGA GTP Transceiver Power Modules

By: Murali Malla, Member of Technical Staff
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 Sep 27, 2012

Abstract: This reference design enables a complete solution for powering Xilinx® Virtex®-6 FPGA GTX transceivers and Spartan®-6 FPGA GTP transceivers using Maxim's power-supply solutions.

This fully tested reference design provides a complete solution for powering Xilinx Virtex-6 field-programmable gate array (FPGA) GTX transceivers (on the Xilinx ML623 board) and Spartan-6 FPGA GTP transceivers (on the Xilinx SP623 board) using Maxim's power-supply solutions. The GTX and GTP transceivers require two distinct power-supply rails each as follows:

Design Description—Virtex-6 FPGA GTX Transceiver				
Power Rail	Input Voltage (V)	Output Voltage (V)	Current (A)	Maxim Solution
MGTAVCC	12	1.025	10	MAX8686
MGTAVTT	12	1.2	6	MAX8686

Design Description—Spartan-6 FPGA GTP Transceiver				
Power Rail	Input Voltage (V)	Output Voltage (V)	Current (A)	Maxim Solution
MGTAVCC	12	1.2	10	MAX8686
MGTAVTT	12	1.2	6	MAX8686

These reference designs provide the required two power rails using four [MAX8686](#) monolithic synchronous step-down converters. The GTX and GTP transceiver power-supply block diagrams are shown in **Figure 1** and **Figure 2**.

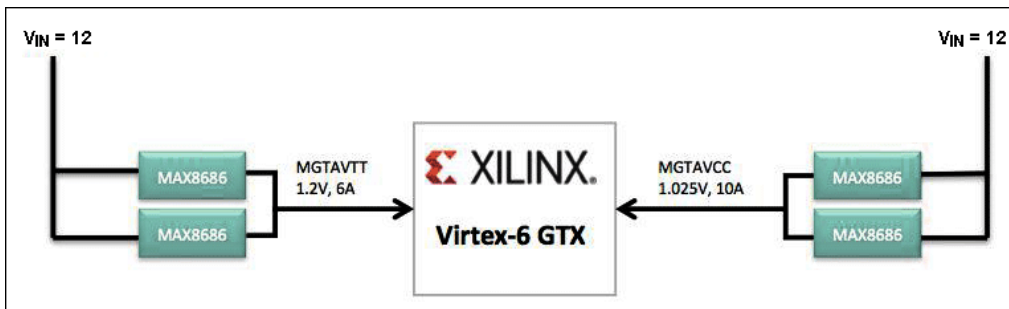


Figure 1. Block diagram of the Virtex-6 GTX power architecture.

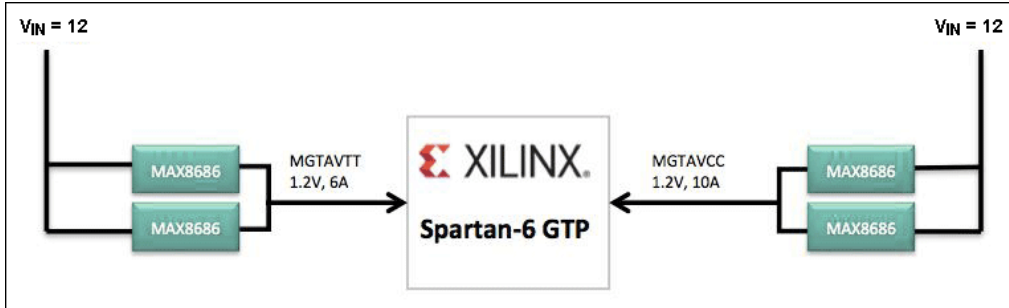
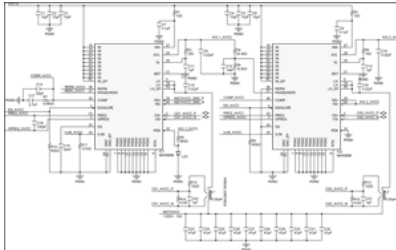


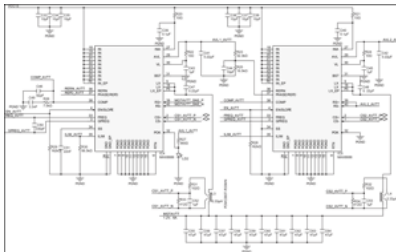
Figure 2. Block diagram of the Spartan-6 GTP power architecture.

Detailed schematics for each point of load (POL) are shown below in **Figures 3** through **6**, and the complete bill of materials (BOM) is included at the end of this document. The **MAXGTXREFDES** and **MAXGTPREFDES** evaluation boards for the Virtex-6 FPGA GTX transceiver and the Spartan-6 FPGA GTP transceiver, respectively, are available for purchase from Maxim's website.



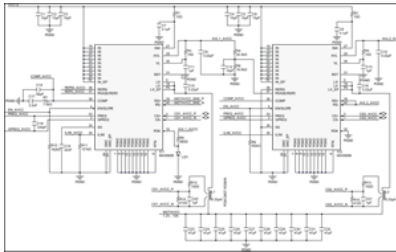
[More detailed image](#) (PDF, 389kB)

Figure 3. Two MAX8686 are used to supply 1.025V/10A for MGTAVCC (Virtex-6 GTX).



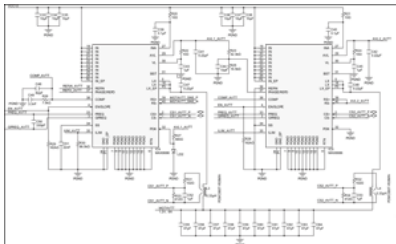
[More detailed image](#) (PDF, 392kB)

Figure 4. Two MAX8686 are used to supply 1.2V/6A for MGTAVTT (Virtex-6 GTX).



[More detailed image](#) (PDF, 387kB)

Figure 5. Two MAX8686 are used to supply 1.2V/10A for MGTAVCC (Spartan-6 GTP).



[More detailed image](#) (PDF, 385kB)

Figure 6. Two MAX8686 are used to supply 1.2V/6A for MGTAVTT (Spartan-6 GTP).

Table 1. BOM for the Virtex-6 FPGA GTX Transceiver

Designator	Quantity	Value	Comment	Description	LibRef	Manufacturer	Footprint
BTN1, BTN2	2		SW-P8008	Push button switch, SPST, thru hole	SW-P8008		SW-P8008
C1, C2, C3, C4, C5, C6, C33, C34, C35, C36, C37, C38	12	10µF	16V, X7R	Generic capacitor	Capacitor		CAP1210
C7, C8, C22, C39, C40, C54, C66, C69	8	0.1µF	16V, X7R	Generic capacitor	Capacitor		CAP0603
C9, C10, C15, C16, C41, C42, C47, C48, C67, C70	10	0.22µF	16V, X7R	Generic capacitor	Capacitor		CAP0603
C11, C13, C20, C21, C43, C45, C52, C53, C65, C68	10	1µF	16V, X7R	Generic capacitor	Capacitor		CAP0603
C12, C44	2	10pF	50V, COG	Generic capacitor	Capacitor		CAP0603
C14, C46	2	82pF	50V, COG	Generic capacitor	Capacitor		CAP0603
C17	1	2.7nF	50V, COG	Generic capacitor	Capacitor		CAP0603
C18, C50	2	330pF	50V, COG	Generic capacitor	Capacitor		CAP0603
C19, C51	2	22nF	16V, X7R	Generic capacitor	Capacitor		CAP0603
C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64	20	47µF	6.3V, X7R	Generic capacitor	Capacitor		CAP1210
C49	1	3.3nF	50V, COG	Generic capacitor	Capacitor		CAP0603
IC1, IC2, IC4, IC5	4		MAX8686	25A single/multiphase, step-down, DC-DC converter	MAX8686	Maxim	TQFN40-EP
IC3	1	Not Populated	MAX5417M	256-tap, nonvolatile, I2C-interface, digital potentiometers	MAX5417/MAX5418/MAX5419	Maxim	TDFN8-EP
IC6	1	Not Populated	MAX5417L	256-tap, nonvolatile, I2C-interface, digital potentiometers	MAX5417/MAX5418/MAX5419	Maxim	TDFN8-EP
IC7, IC8	2		MAX4373T	Micropower, high-side current-sense amplifier + comparator + reference	MAX4373	Maxim	MSOP8-MS
J1	1		MPS-06-7.70-01-L-V	25A dual leaf socket	MPS-06-7.70-01	Samtec	MPS-06-7.70-01
J2	1		BSE-020-01-L-D-A	2x20 position basci blade&beam socket	BSE-020-01-L-D	Samtec	BSE-020-01-L-D
				Jumper 100mil			

JP1, JP2	2		JMP-1x2	1x2	JMP-1x2		JPR-1x2
L1, L2, L3, L4	4	0.33µH	PCMC063T-R33MN	Generic inductor with Kelvin connection	IND-CURRENT	Susumu	PCMC063T
LD1, LD2	2		Red highbright	Generic LED	LED		D0603
Q1, Q2	2		2N7002DW	Dual N-channel FET	2N7002DW	Fairchild Semiconductor	SOT-363
R1, R2, R3, R5, R20, R21, R22, R24	8	10	0.1W, 1%	Generic resistor	Resistor		RES0603
R4, R23, R38	3	52.3kΩ	1%	Generic resistor	Resistor		RES0603
R6, R25	2	16.5kΩ	1%	Generic resistor	Resistor		RES0603
R7	1	8.06kΩ	1%	Generic resistor	Resistor		RES0603
R8, R27	2	560Ω	1%	Generic resistor	Resistor		RES0603
R9, R10, R28, R29	4	162kΩ	1%	Generic resistor	Resistor		RES0603
R11	1	121kΩ	1%	Generic resistor	Resistor		RES0603
R12, R13, R31, R32	4	102Ω	1%	Generic resistor	Resistor		RES0603
R14, R15, R33, R34	4	412Ω	1%	Generic resistor	Resistor		RES0603
R16	1	140kΩ	1%	Generic resistor	Resistor		RES0603
R17, R36, R39, R40, R42, R45, R46, R49, R50	9	10kΩ	1%	Generic resistor	Resistor		RES0603
R18	1	63.4kΩ	1%	Generic resistor	Resistor		RES0603
R19	1	47.5kΩ	1%	Generic resistor	Resistor		RES0603
R26	1	7.5kΩ	1%	Generic resistor	Resistor		RES0603
R30	1	66.5kΩ	1%	Generic resistor	Resistor		RES0603
R35	1	121kΩ	1%	Generic resistor	Resistor		RES0603
R37	1	69.8kΩ	1%	Generic resistor	Resistor		RES0603
R41	1	1kΩ	1%	Generic resistor	Resistor		RES0603
R43	1	8.25kΩ	1%	Generic resistor	Resistor		RES0603
R47	1	1.65kΩ	1%	Generic resistor	Resistor		RES0603
R44, R48	2	13kΩ	1%	Generic resistor	Resistor		RES0603

Table 2. BOM for the Spartan-6 FPGA GTP Transceiver

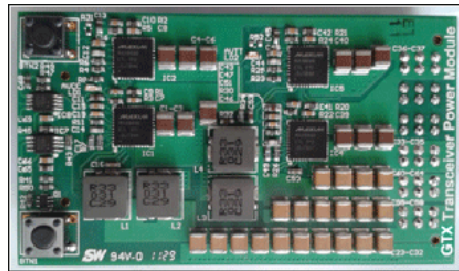
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C7, C8, C22, C39, C40, C54, C66, C69	8	0.1µF	16V, X7R	Generic capacitor	Capacitor		CAP0603
C9, C10, C15, C16,							

C41, C42, C47, C48, C67, C70	10	0.22μF	16V, X7R	Generic capacitor	Capacitor		CAP0603
C11, C13, C20, C21, C43, C45, C52, C53, C65, C68	10	1μF	16V, X7R	Generic capacitor	Capacitor		CAP0603
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C17, C49	2	3.3nF	50V, COG	Generic capacitor	Capacitor		CAP0603
C18, C50	2	330pF	50V, COG	Generic capacitor	Capacitor		CAP0603
C19, C51	2	22nF	16V, X7R	Generic capacitor	Capacitor		CAP0603
C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64	20	47μF	6.3V, X7R	Generic capacitor	Capacitor		CAP1210
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IC3	1	Not populated	MAX5417M	256-tap, nonvolatile, I2C-interface, digital potentiometers	MAX5417/MAX5418/MAX5419	Maxim	TDFN8-EP
IC6	1	Not populated	MAX5417L	256-tap, nonvolatile, I2C-interface, digital potentiometers	MAX5417/MAX5418/MAX5419	Maxim	TDFN8-EP
IC7, IC8	2		MAX4373T	Micropower, high-side current-sense amplifier + comparator + reference	MAX4373	Maxim	MSOP8-MS
J1	1		MPS-06-7.70-01-L-V	25A dual leaf socket	MPS-06-7.70-01	Samtec	MPS-06-7.70-01
J2	1		BSE-020-01-L-D-A	2x20 position basic blade&beam socket	BSE-020-01-L-D	Samtec	BSE-020-01-L-D
JP1, JP2	2		JMP-1x2	Jumper 100mil 1x2	JMP-1x2		JPR-1x2
L1, L2, L3, L4	4	0.33μH	PCMC063T-R33MN	Generic inductor with Kelvin Connection	IND-CURRENT	Susumu	PCMC063T
LD1, LD2	2		Red highbright	Generic LED	LED		D0603
Q1, Q2	2		2N7002DW	Dual N-channel FET	2N7002DW	Fairchild Semiconductor	SOT-363
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R4, R19, R23, R38	4	52.3kΩ	1%	Generic resistor	Resistor		RES0603
R6, R25	2	16.5kΩ	1%	Generic resistor	Resistor		RES0603
R7, R26	2	7.5kΩ	1%	Generic resistor	Resistor		RES0603
R8, R27	2	560Ω	1%	Generic resistor	Resistor		RES0603

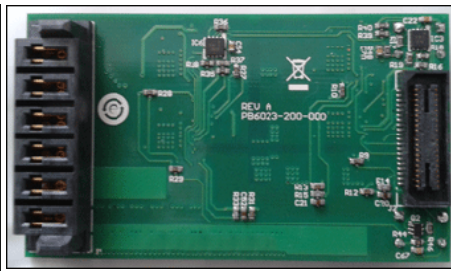
R9, R10, R28, R29	4	162kΩ	1%	Generic resistor	Resistor	RES0603
R11	1	121kΩ	1%	Generic resistor	Resistor	RES0603
R30	1	66.5kΩ	1%	Generic resistor	Resistor	RES0603
R12, R13, R31, R32	4	102Ω	1%	Generic resistor	Resistor	RES0603
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R18, R37	2	69.8kΩ	1%	Generic resistor	Resistor	RES0603
R41	1	1kΩ	1%	Generic resistor	Resistor	RES0603
R43	1	8.25kΩ	1%	Generic resistor	Resistor	RES0603
R47	1	1.65kΩ	1%	Generic resistor	Resistor	RES0603
R44, R48	2	13kΩ	1%	Generic resistor	Resistor	RES0603

Board Image

GTX Power Module

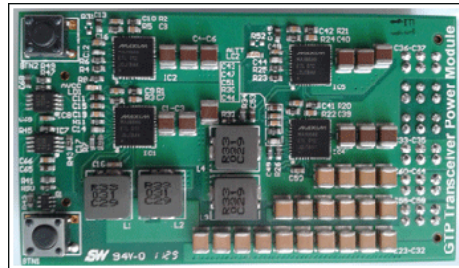


Top view

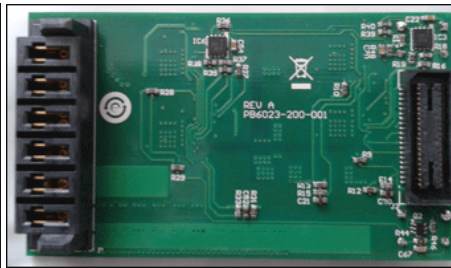


Bottom view

GTP Power Module



Top view



Bottom view

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Related Parts

MAX8686	Single/Multiphase, Step-Down, DC-DC Converter Delivers Up to 25A Per Phase	Free Samples
MAXGTPREFDES	Spartan-6 FPGA GTP Transceiver Power Module	
MAXGTXREFDES	Virtex-6 FPGA GTX Transceiver Power Module	

More Information

For Technical Support: <http://www.maximintegrated.com/support>

For Samples: <http://www.maximintegrated.com/samples>

Other Questions and Comments: <http://www.maximintegrated.com/contact>

Application Note 5481: <http://www.maximintegrated.com/an5481>

REFERENCE DESIGN 5481, AN5481, AN 5481, APP5481, Appnote5481, Appnote 5481

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