

Flexible Power Management Units for Low-Power Xilinx FPGAs

I²C Interface Provides Output Voltage Control and Startup/Shutdown Sequencing

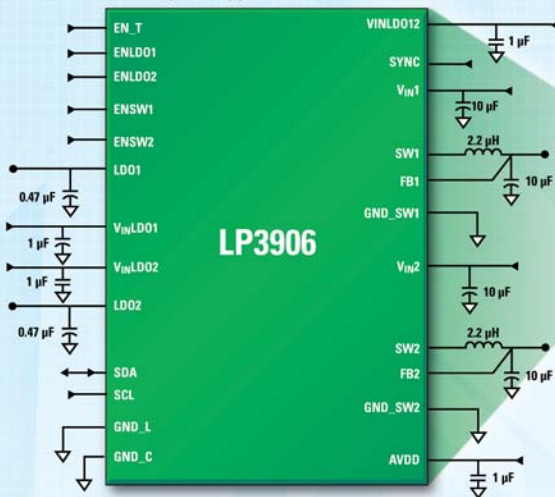
LP3906 includes:

- Two high-efficiency buck DC-DC converters
 - Programmable V_{OUT} from 0.8V to 3.3V
 - 1.5A output current
 - 2 MHz PWM switching frequency
 - $\pm 3\%$ output voltage accuracy
- 2 Linear regulators (LDO)
 - Programmable V_{OUT} from 1.0V to 3.5V
 - $\pm 3\%$ output voltage accuracy
 - 300 mA output currents

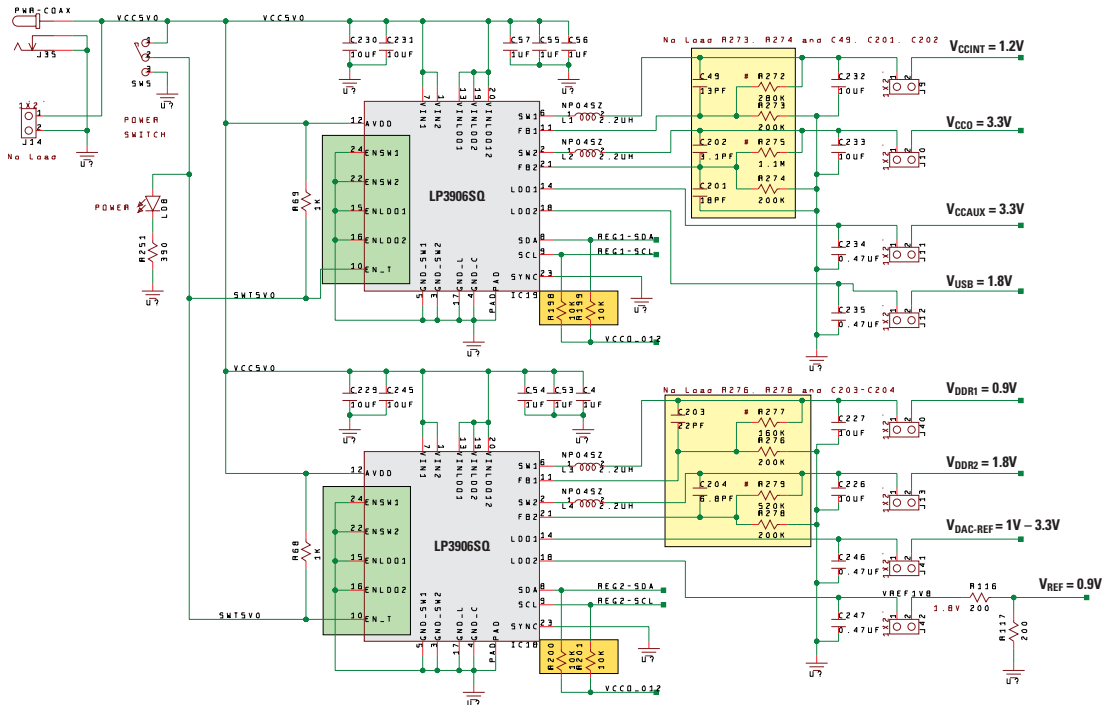
LP3906 allows programmability through I²C serial interface.
Available in 4 mm x 5 mm LLP-24 packaging.

AVAILABLE
LEAD-FREE

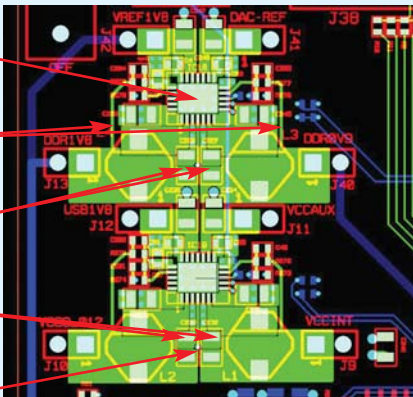
Typical Application Circuit



Schematic and Layout Tips



- 1. External feedback resistor/cap network not required for standard voltage options
- 2. GND the enable pins for specific sequencing
- 3. I²C pins need pull-up resistors



Design Tips

- ① Pin 4: have GND pin move away from switcher components before punch a via to GND
- ② Bucks must have separate GND islands
- ③ C_{IN} & C_{OUT} capacitors: try to place close as possible to pins
- ④ Keep switch feedback pins away from noise, while keeping them short
- ⑤ Recommend system GNDs connected to center GND pad

For detailed layout guidelines on switching power supplies, see Application Note (AN-1147)

Power Supply Solutions for FPGAs

Spartan FPGAs

	$V_{IN} = 3.3V$	$4.5V < V_{IN} < 5.5V$	$8V < V_{IN} < 14V$
Internal Core Logic Supply			
Spartan 3, 3E	1.2V LM3674 (<600 mA) sync regulator	LM2853 (<3A) sync regulator	LM3100 (<1.5A) sync regulator
Spartan 2	1.8V LM3670 (<300 mA) sync regulator	LM2852 (<2A) sync regulator	LM2679 (<5A) non-sync regulator
I/O Voltage Supply			
	1.2V LM2853 (<3A) sync regulator	LM3743 (<10A) sync controller	LM2747 (>2.5A) sync controller
	1.5V LM2852 (<2A) sync regulator	LM1771 (<6A) sync controller	LM25005 (<2.5A) non-sync regulator
	1.8V LP3875 (<1A) LDO	LM2853 (<3A) sync regulator	LM3100 (<1.5A) sync regulator
	2.5V LM3674 (<600 mA) sync regulator	LM2832 (<2A) non-sync regulator	LM2734 (<1A) non-sync regulator
	3.3V LM3670 (<300 mA) sync regulator	LM2830 (<1A) non-sync regulator	LM2736 (<750 mA) non-sync regulator
Auxiliary Logic Supply			
Spartan 3, 3E	2.5V LM3674 (<600 mA) sync regulator	LM1771 (<6A) sync controller	LM2747 (>2.5A) sync controller

Virtex FPGAs

	$V_{IN} = 3.3V$	$4.5V < V_{IN} < 5.5V$	$8V < V_{IN} < 14V$
Internal Core Logic Supply			
Virtex 5	1V LM2853 (<3A) sync regulator	LM1771 (<6A) sync controller	LM2747 (>2.5A) sync controller
Virtex 4	1.2V LP38856 (<3A) LDO	LM3475 (<10A) non-sync controller	LM25005 (<2.5A) non-sync regulator
Virtex II, Pro	1.5V LM2852 (<2A) sync regulator	LM2832 (<2A) non-sync regulator	LM3100 (<1.5A) sync regulator
Virtex-E	1.8V LP3875 (<1A) LDO	LM2831 (<1.5A) non-sync regulator	LM2734 (<1A) non-sync regulator
Virtex	2.5V LP3981 (<300 mA) LDO	LM2830 (<1A) non-sync regulator	LM2736 (<750 mA) non-sync regulator
I/O Voltage Supply			
	1.2V LM2853 (<3A) sync regulator	LM3743 (<10A) sync controller	LM2747 (>2.5A) sync controller
	1.5V LM2852 (<2A) sync regulator	LM1771 (<6A) sync controller	LM25005 (<2.5A) non-sync regulator
	1.8V LP3875 (<1A) LDO	LM2853 (<3A) sync regulator	LM3100 (<1.5A) sync regulator
	2.5V LM3674 (<600 mA) sync regulator	LM2832 (<2A) non-sync regulator	LM2734 (<1A) non-sync regulator
	3.3V LM3670 (<300 mA) sync regulator	LM2830 (<1A) non-sync regulator	LM2736 (<750 mA) non-sync regulator
Auxiliary Logic Supply			
Virtex 5, 4, II, II Pro	2.5V LM3674 (<600 mA) sync regulator	LM1771 (<6A) sync controller	LM2747 (>2.5A) sync controller
Virtex II	3.3V LP3981 (<300 mA) LDO	LM2853 (<3A) sync regulator	LM2672 (<1A) non-sync regulator

Multiple Output Regulators

Product ID	Number of Regulators	V_{IN} Range	V_{OUT} Range	Total I_{OUT} Max (A)	Features	Package
LP3906	4	2.7V to 5.5V	0.8V to 3.5V	3.6	Dual 1.5A buck, dual 300 mA LDO, I ² C interface, Spread Spectrum Capability	LLP-24
LP3905	4	3V to 5.5V	1V to 3.3V	1.5	Dual 600 mA buck, dual 150 mA LDO, I ² C interface	LLP-14
LM3370	2	2.7V to 5.5V	1V to 3.3V	1.2	Dual 600 mA buck, I ² C interface, Spread Spectrum Capability	LLP-16
LM2717	2	4V to 20V	1.2V to 15V	5.4	Dual 2.2A and 3.2A non-sync buck	TSSOP-24
LP3996	2	2V to 6V	0.8V to 3.3V	0.45	Dual 300 mA and 150 mA LDO w/power-on-reset	LLP-10
LM5642	2	4.5V to 36V	1.3V to 34V	40	Dual synchronous buck controller w/oscillator synchronization	TSSOP-28

Power Design Tools

For more information including application notes and articles on powering FPGAs see: www.national.com/digics

Power Designer #109, *Advanced Topics in Powering FPGAs*

Power Designer #102, *Power Management Considerations for FPGAs and ASICs*

AN-1149, *Layout Guidelines for Switching Power Supplies*

Power Designer #114, *Best Layout Practices for Switching Power Supplies*

Analog Edge article, *Fixing EMI Across the Board*

AN-1261, *Power Supply Effects on Noise Performance*

AN-1050, *Understanding and Eliminating EMI in Microcontroller Applications*

Power Expert Design Tools for Xilinx FPGAs – Easy as 1-2-3

1. Select an FPGA/CPLD family and device
2. Specify the operating conditions
3. Pick a National Semiconductor power management solution

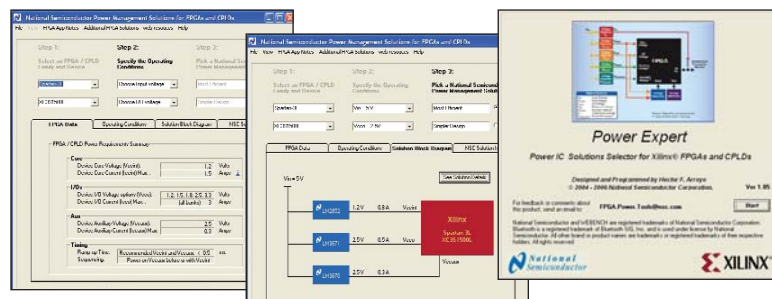
And receive an instant **Solution Block Diagram** complete with solution details, and go directly into the WEBENCH® online design environment.

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