

Professional and Broadcast Video

Solutions Guide

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2010 Vol. 1

SDI

SerDes Solutions

Clock and Timing Solutions

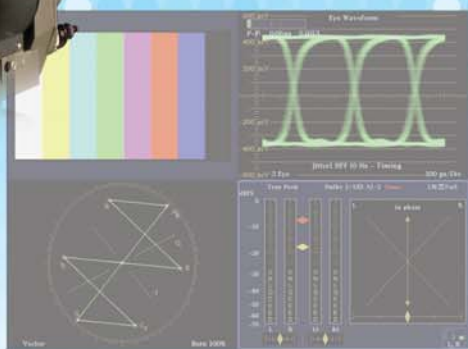
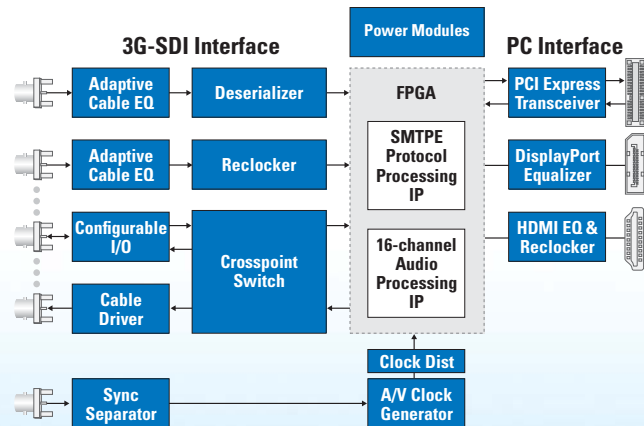
HDMI/DVI/DisplayPort

Analog Video Solutions

Audio Solutions

Power Solutions

Design Resources



Professional and Broadcast Video

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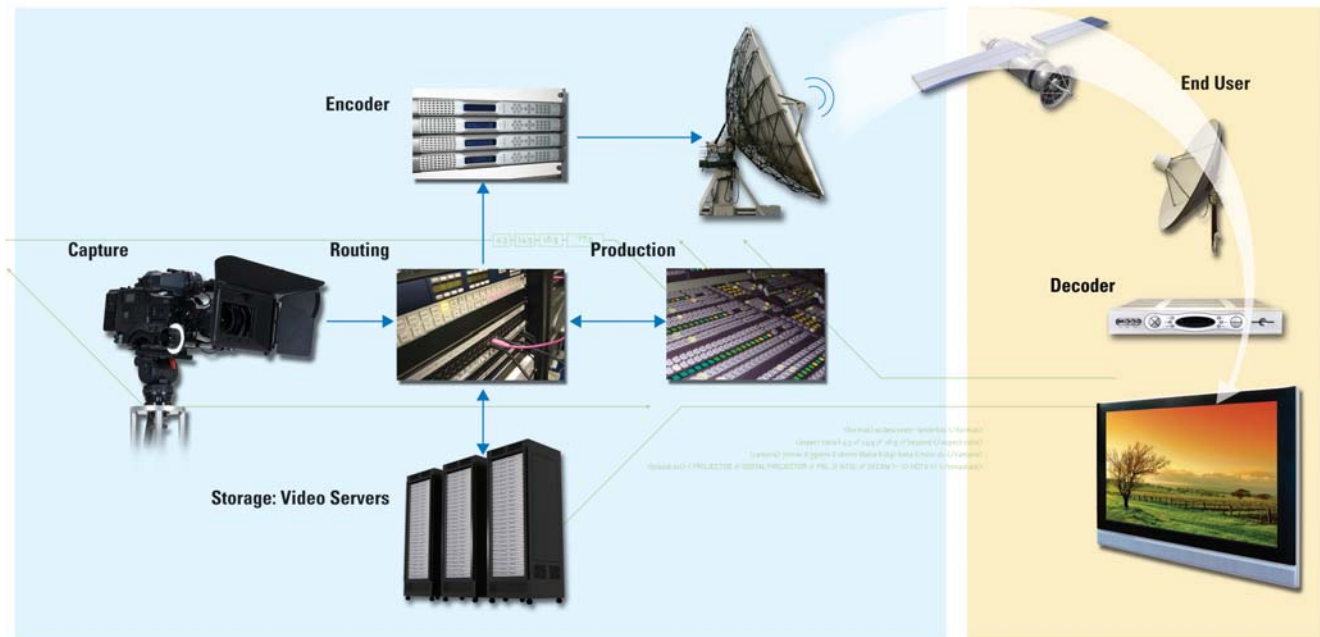
Accelerate Time to Market with National's Easy-to-Use Video Solutions

For decades, National Semiconductor has been a trusted advisor and solutions provider to the professional and broadcast video industry. National continues to offer the industry's most comprehensive portfolio of analog and mixed-signal solutions. Energy-efficient, easy-to-use products save design time and reduce development costs to get your products to market more quickly.

Solutions from National Deliver:

- User friendly plug-and-play solutions simplify design, require fewer board spins, and reduce time to market
- Highly integrated products replace multiple devices, reduce system BOM, and save board area
- Best-in-class performance
 - Industry-leading jitter performance enables longer cable reach and margin to exceed SMPTE specifications
 - Advanced PowerWise® features provide intelligent diagnostics to evaluate operating conditions and scale power to maximize system-level energy savings

Production Studio Development to Delivery



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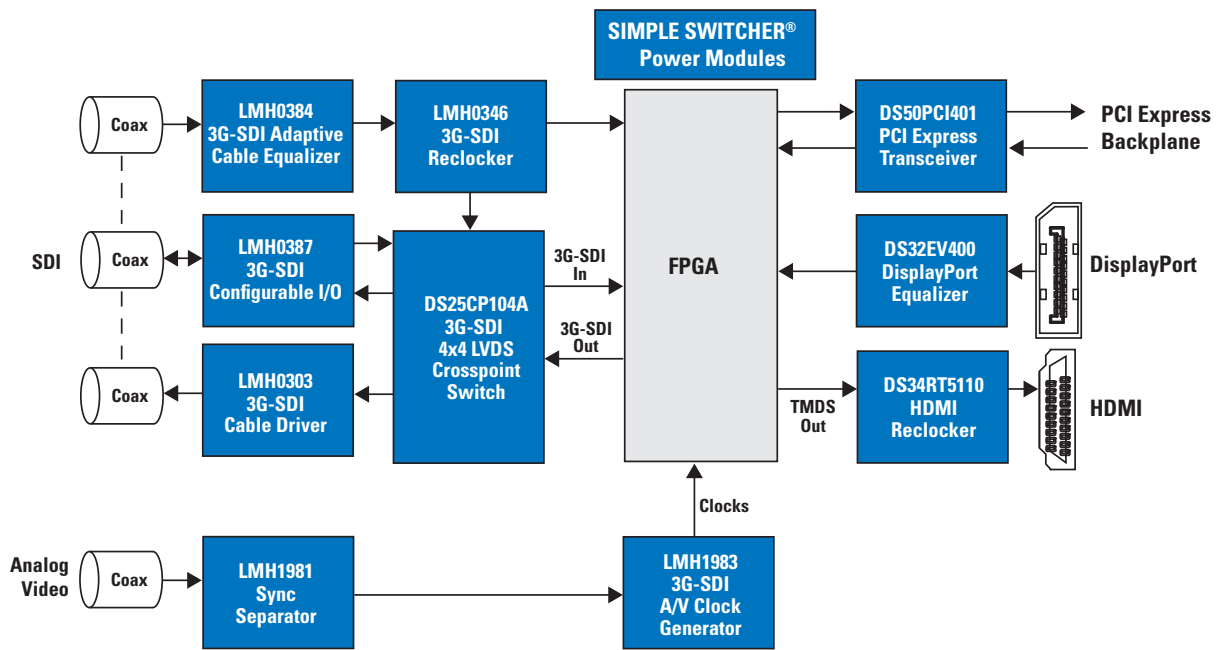
SDI Solutions

Comprehensive Source for All Video Solutions

National Semiconductor is the only Tier 1 semiconductor supplier to offer a complete end-to-end solution for the professional video market. National offers easy to use solutions for various video protocols including SDI, analog video, DisplayPort, and HDMI.

Video solutions from National deliver best-in-class jitter performance, system wide energy efficiency, and small package size for your design. For more information, visit National's professional video website at national.com/sdi.

3G/HD/SD SDI Switcher Block Diagram



Core SDI Portfolio

Max Data Rate	Configurable I/O	Equalizers	Reclockers	Cable Drivers	Serializers	Deserializers	Video Clcking
3G	LMH0387	LMH0384 LMH0344	LMH0356 LMH0346	LMH0307 LMH0303 LMH0302	LMH0340	LMH0341	LMH1983 LMH1982 LMH1981
HD	—	LMH0044 LMH0034	LMH0056 LMH0046	LMH0202 LMH0002	LMH0050 LMH0040 LMH0030	LMH0051 LMH0041 LMH0031	—
SD	—	LMH0074 LMH0024	LMH0036 LMH0026	LMH0001	LMH0070	LMH0071	—

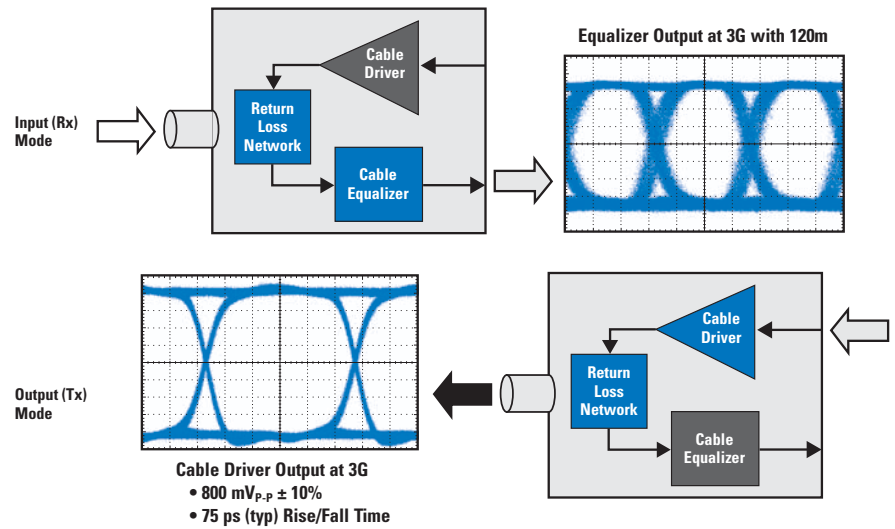
LMH0387 – 3G-SDI Configurable I/O with Integrated Return Loss Network

Features

- Programmable as input (equalizer) or output (cable driver)
- Integrated return loss network simplifies design and reduces BOM cost
 - 5 dB margin to SMPTE specification
- Supports SMPTE standards 424M (3G), 292M (HD) 259M/C (SD), and DVB-ASI
- Equalized cable lengths (Belden 1694A cable)
 - 120m at 3G, 200m at HD, 400m at SD

Applications

Ideal for any SDI input or output.



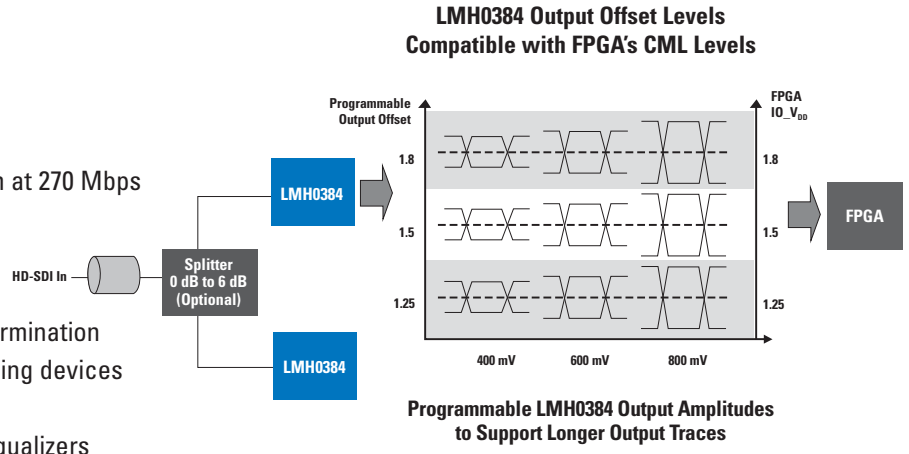
Conventional Approach	National's Innovative Approach	Benefits
<p>Dedicated inputs and outputs</p> <p>And</p>	<p>Flexible I/O</p>	<p>Uses a single BNC for either input or output</p> <p>Optimizes BNC usage</p>
<p>Complex return loss networks</p>	<p>No external return loss network needed</p>	<p>Meets challenging SMPTE return loss specifications</p> <p>Plug-and-play solution</p> <p>Reduces board area/BOM cost</p> <p>Faster time to market with fewer board spins</p>
<p>Multiple boards: One per I/O configuration</p>	<p>One board: Supports multiple I/O configurations</p>	<p>Configurable during studio installation</p> <p>Simplifies design</p> <p>Reduces inventory costs by stocking fewer models</p>

SDI PowerWise® Equalizer

LMH0384 – Configurable 3G SDI Adaptive Cable Equalizer

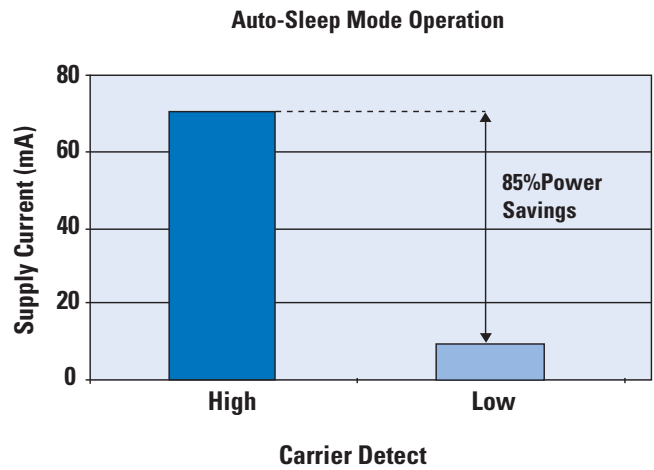
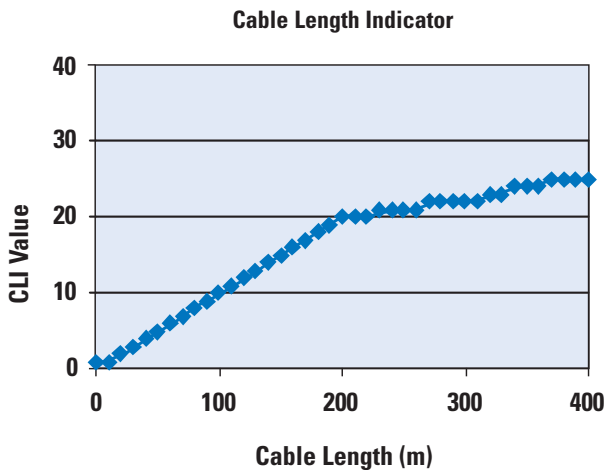
Features

- SMPTE-standard compliant
 - Supports SMPTE 424M (3G), 292M (HD), 259M/C (SD), and DVB-ASI
- Equalized cable lengths (Belden 1694A cable)
 - 140m at 2.97 Gbps, 200m at 1.485 Gbps, 400m at 270 Mbps
- Power-save mode with auto-sleep control
 - Detects presence of valid input signal
 - 85% power savings in power-save mode
- Low-power LVDS output driver with internal termination
 - Allows DC coupling to most signal conditioning devices
- Two selectable modes of operation
 - Pin mode: compatible with other National equalizers (LMH0344, LMH0044/74)
 - Register mode: SPI interface to access enhanced feature set
- Enhanced feature set in Register mode
 - Cable length indicator
 - Bypass and output mute threshold
 - Input amplitude control: allows operation with external splitters
 - Programmable output common-mode voltage and swing to enable direct coupling to deep sub-micron geometry CMOS FPGAs



Applications

Ideal for any video equipment with 3G-SDI inputs including routers, switchers, editing equipment, distribution amplifiers, and servers.

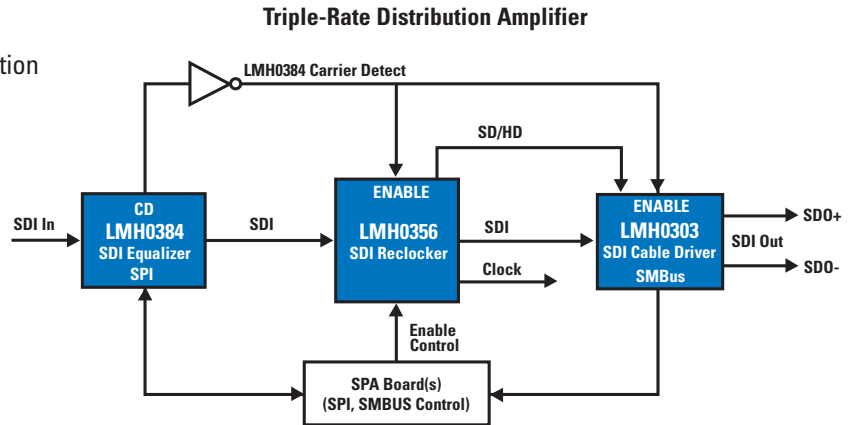


SDI Equalizers, Reclockers, and Cable Drivers

PowerWise® Triple-Rate Distribution Amplifier

Features

- Intelligent sensing reduces system power consumption
- Auto signal detection at equalizer input
- Cable detection at driver output
- 95% power savings in power-save mode
- Triple-rate SMPTE support for 424M (3G), 292M (HD), 259M/C (SD), and DVB-ASI



Product ID	Key Features	Supply Voltage (V)	Typ Power (mW)	Data Rate (Mbps)	Temp Range	Packaging
Configurable I/O						
NEW! LMH0387 ^E	3G/HD/SD, integrated return loss network	3.3	210	143 to 2970	-40° to 85°C	CSP-48
Adaptive Cable Equalizers						
LMH0384 ^E	3G/HD/SD, extended reach	3.3	230	143 to 2970	-40° to 85°C	LLP-16
LMH0344 ^E	3G/HD/SD	3.3	280	143 to 2970	-40° to 85°C	microArray-25, LLP-16
LMH0044 ^E	HD/SD	3.3	208	143 to 1485	0° to 85°C	LLP-16
LMH0034 ^E	HD/SD	3.3	208	143 to 1485	0° to 85°C	SOIC-16
LMH0074 ^E	SD, cable detect	3.3	208	143 to 540	-40° to 85°C	LLP-16
Reclockers						
LMH0346 ^E	3G/HD/SD, dual differential outputs	3.3	370	270 to 2970	-40° to 85°C	eTSSOP-20, LLP-24
LMH0356 ^E	3G/HD/SD, 4:1 input mux, FR4 equalization	3.3	430	270 to 2970	-40° to 85°C	LLP-48, LLP-40
LMH0046 ^E	HD/SD, dual differential outputs	3.3	330	143 to 1485	-40° to 85°C	eTSSOP-20
LMH0056 ^E	HD/SD, 4:1 input mux, FR4 equalization	3.3	360	143 to 1485	-40° to 85°C	LLP-48
LMH0026 ^E	SD, dual differential outputs	3.3	330	270	-40° to 85°C	eTSSOP-20
LMH0036 ^E	SD, 4:1 input, FR4 equalization	3.3	350	270	-40° to 85°C	LLP-48
Cable Drivers						
LMH0307 ^E	Dual 3G/HD/SD SDI, cable detect, input LOS, selectable slew rate, 4 mW power-down mode	3.3	275	Up to 2970	-40° to 85°C	microArray-25, LLP-16
LMH0302 ^E	3G/HD/SD, enable feature	3.3	165	Up to 2970	-40° to 85°C	LLP-16
LMH0303 ^E	3G/HD/SD SDI, cable detect, input LOS, selectable slew rate, 4 mW power-down mode	3.3	155	Up to 2970	-40° to 85°C	LLP-16
LMH0002 ^E	HD/SD SDI, selectable slew rate	3.3	149	Up to 1485	-40° to 85°C	SOIC-8
LMH0002 ^E	HD/SD SDI, selectable slew rate	3.3	149	Up to 1485	-40° to 85°C	LLP-16
LMH0202 ^E	HD/SD SDI, dual differential input and output	3.3	298	Up to 1485	0° to 70°C	TSSOP-16
LMH0001 ^E	SD, serial, digital, adjustable output amplitude	3.3	125	Up to 540	-40° to 85°C	LLP-16

PowerWise® product ^E Evaluation board

SDI Serializers and Deserializers

Flexible IP and High-Performance SerDes for Future-Proof System Solutions

National's SDI SerDes devices and SMPTE protocol processing FPGA firmware provide a complete system solution. Unlike competing solutions that combine SerDes functionality with SMPTE processing in a single chip, National's solution:

- Provides system designers an easy-upgrade firmware path to keep up with evolving SMPTE specifications
- Eliminates time-consuming, expensive silicon re-spins
- Eliminates need for additional board qualifications
- Supplies future-proof system design
- Reduces lifetime cost-of-system maintenance

High-end FPGAs with integrated transceivers use low-geometry CMOS processes and have a high noise floor, causing poor jitter performance. To compensate, designers need additional components such as premium regulators, reference clocks, isolated power and ground planes, and thermal protection that increase design complexity, time, and cost. In contrast, National's SerDes solutions work with cost-effective FPGAs requiring few additional components.

National delivers the industry's lowest-output-jitter solution (30 ps p-p) in a package that is 60% smaller than competing solutions. The smaller size enables optimal placement of the SerDes close to BNC connectors, facilitating return loss network design.

Comparison of System Design Options

	National SerDes	High-end FPGA with Integrated SerDes	SerDes with Integrated SMPTE Processing
Supports SMPTE levels A and B	✓	✓	—
System design flexibility evolves with changing standards	✓	✓	—
Good jitter performance	✓	—	✓
Small board area (device + additional components)	✓	—	—
Upgradable firmware	✓	✓	—
Lower bill of materials (BOM) cost	✓	—	—
Faster time to market	✓	—	✓
Embedded audio support (up to 16 channels)	✓	—	—

SDI Serializers and Deserializers

Product ID	Key Features	Supply Voltage (V)	Typ. Power (mW)	Data Rate (Mbps)	Temp Range	Packaging
Serializers						
LMH0340 ^E	3G/HD/SD, LVDS interface, integrated cable driver	3.3, 2.5	440	270 to 2970	-40° to 85°C	LLP-48
LMH0040 ^E	HD/SD, LVDS interface, integrated cable driver	3.3, 2.5	440	270 to 1485	-40° to 85°C	LLP-48
LMH0050 ^E	HD/SD, LVDS interface	3.3, 2.5	460	270 to 1485	-40° to 85°C	LLP-48
LMH0070 ^E	SD, LVDS interface, integrated cable driver	3.3, 2.5	400	270	-40° to 85°C	LLP-48
LMH0030 ^E	HD/SD, FIFOs, integrated cable driver, 85 ps typical output jitter, no external VCOs required, BIST, TPG	3.3, 2.5	430	270 to 1485	0° to 70°C	TQFP-64
Deserializers						
LMH0341 ^E	3G/HD/SD, reclocking, LVDS interface, active loopthrough	3.3, 2.5	590	270 to 2970	-40° to 85°C	LLP-48
LMH0041 ^E	HD/SD, reclocking, LVDS interface, active loopthrough	3.3, 2.5	550	270 to 1485	-40° to 85°C	LLP-48
LMH0051 ^E	HD/SD, reclocking, LVDS interface	3.3, 2.5	555	270 to 1485	-40° to 85°C	LLP-48
LMH0071 ^E	SD, reclocking, LVDS interface, active loopthrough	3.3, 2.5	525	270	-40° to 85°C	LLP-48
LMH0031 ^E	HD/SD, descrambler, FIFOs, 27 MHz reference, BIST, TPG, automatic EDH/CRC	3.3, 2.5	850	270 to 1485	0° to 70°C	TQFP-64

^E Evaluation board

Triple-Rate SDI Development Platforms

Altera FPGAs

In collaboration with Altera, National has developed triple-rate SDI and video clocking daughter cards for Altera FPGA development kits. The daughter cards are compatible with the Stratix-IV, Stratix-III, and Cyclone-III development kits. All plug directly into the host FPGA development board via Altera's high-speed mezzanine connector (HSMC).

National provides FPGA source code for SMPTE protocol processing with the purchase of a development kit or ICs. The FPGA IP, along with the daughter card and the FPGA development kit, provide broadcast video system designers a comprehensive platform for rapid evaluation and prototyping of new designs to reduce time to market.

Altera Development Platform

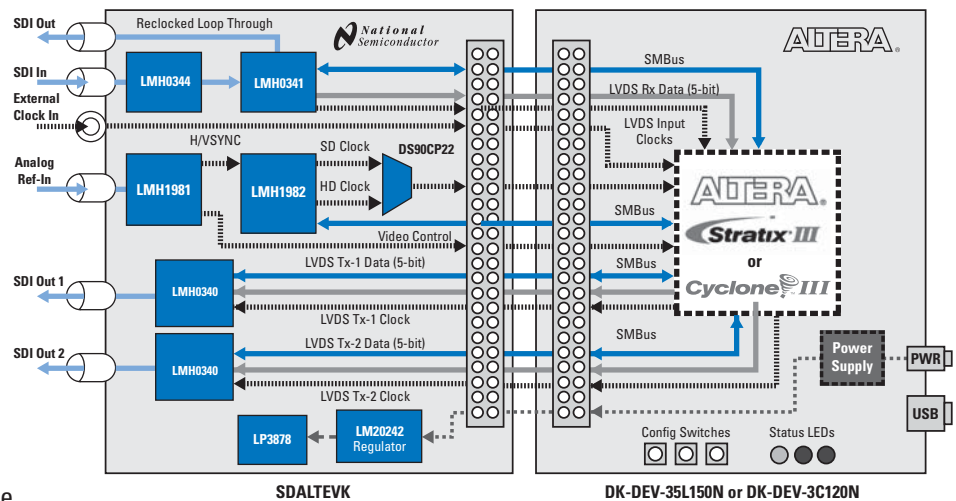
Features

- 3G, HD, and SD compatible
- Comprehensive reference for hardware design and FPGA IP development
- Included HDL (Verilog, VHDL source) supports SDI framing, audio embedding/de-embedding and test pattern generation
 - IP available for both Cyclone-III and Stratix-III FPGAs
- Genlock support

Applications

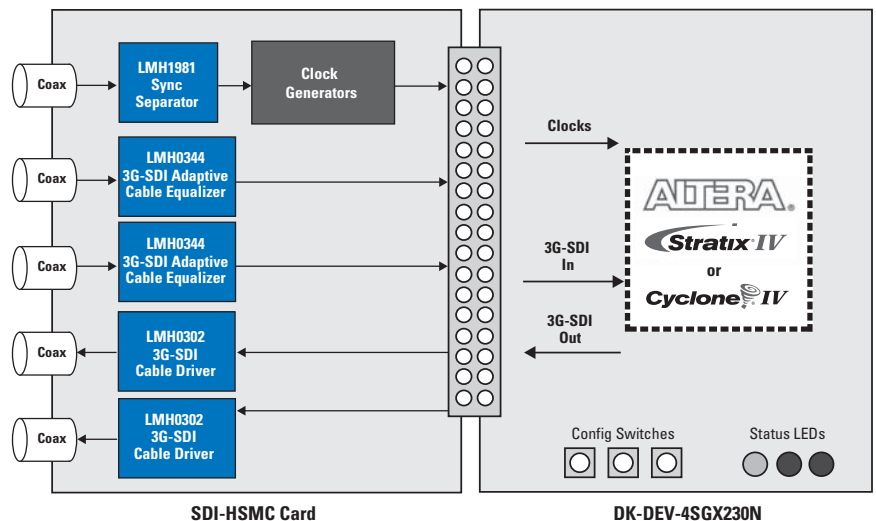
Providing both the hardware and FPGA firmware enables maximum flexibility to modify system design, quickly adapt to standard changes, add features, and reduce time-to-market of video processing cards.

Comprehensive Development Kit for Altera Stratix-III or Cyclone-III FPGAs



NEW!

I/O and Video Clocking Daughter Card for Altera FPGAs with Integrated SerDes



Triple-Rate SDI Development Platforms

Xilinx FPGAs

In collaboration with Avnet and Xilinx, National has developed triple-rate SDI and video clocking daughter cards for Xilinx FPGA development kits. The new FMC daughter card is compatible with both the Virtex-6 and Spartan-6 development kits. It connects to the base board through an FPGA mezzanine connector (FMC). The daughter card is included in the Virtex-6

FPGA Broadcast connectivity kit. National's existing SDXILEVK daughter card plugs directly into Spartan-3A/3E development kits through an EXP connector. The combined solution of the daughter card and the development kit provides broadcast video system designers with a comprehensive platform for rapid evaluation and prototyping of new designs to reduce time to market.

Xilinx Development Platform

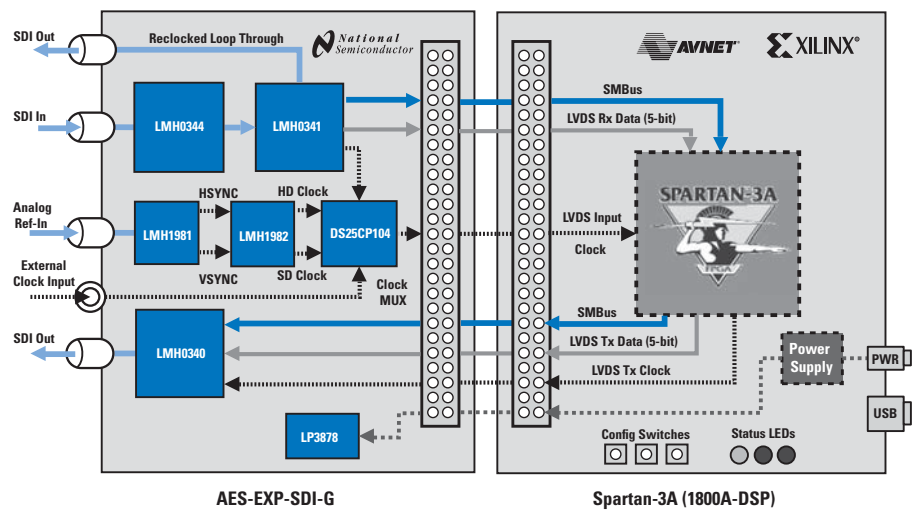
Features

- 3G, HD, and SD compatible
- Comprehensive reference for hardware design and FPGA IP development
 - HDL (Verilog, VHDL) available from AVNET
 - Supports SDI framing, audio embedding/de-embedding and test pattern generation
- Genlock support

Applications

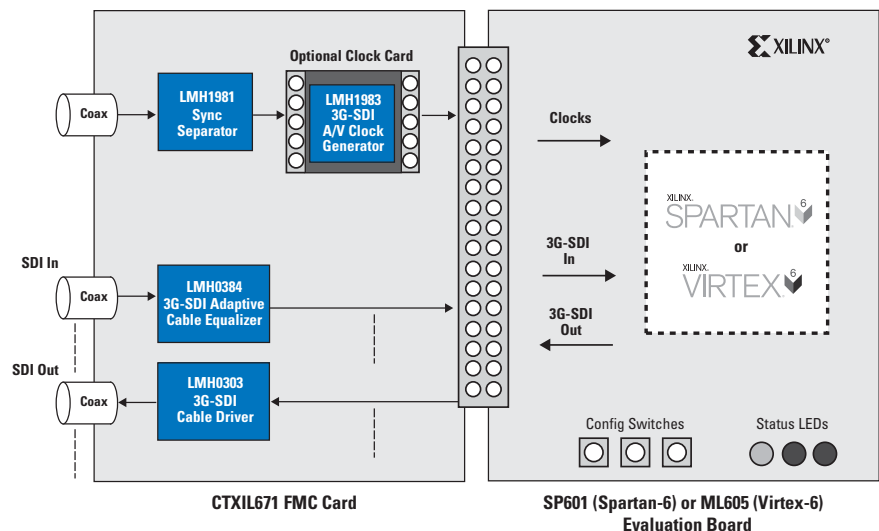
Providing both the hardware and FPGA firmware enables maximum flexibility to modify system design, quickly adapt to standard changes, add features, and reduce time-to-market of video processing cards.

Comprehensive Development Kit for Xilinx Spartan-3A FPGAs



NEW!

I/O and Video Clocking Daughter Card for Xilinx Spartan-6 or Virtex-6 FPGAs



Single-Chip Clocking Solution

LMH1983 – Multi-Rate Audio/Video Clock Generator

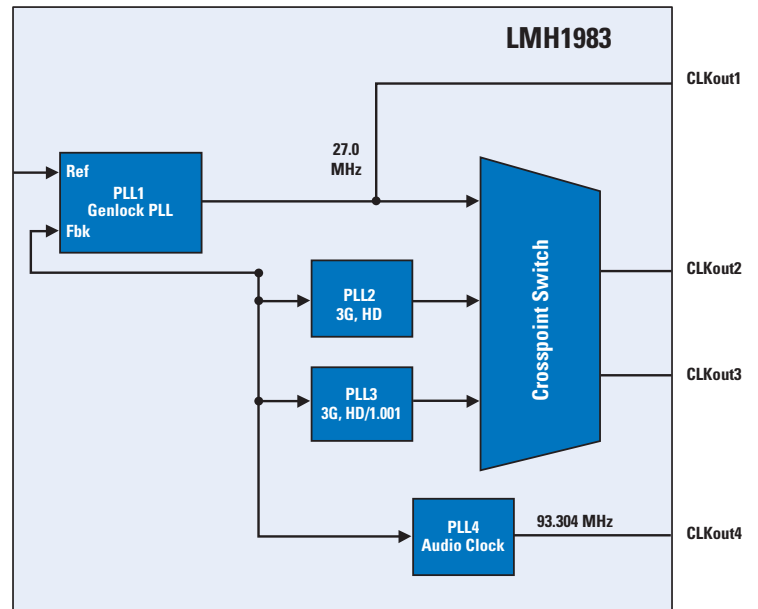
Features

- Replaces expensive external 74 MHz/148 MHz VCXOs
- Four simultaneous LVDS clocks with dedicated Top of Frame (TOF) pulses
- Industry-leading jitter performance of 40 ps_{p-p} output jitter
- Genlock support, digital free run mode
- Automatic input format detection
- Digital frequency holdover on loss of reference
- Each PLL can be independently powered on/off for more power efficient operation
- Plug-and-play solution, no PLL tweaking required

Applications

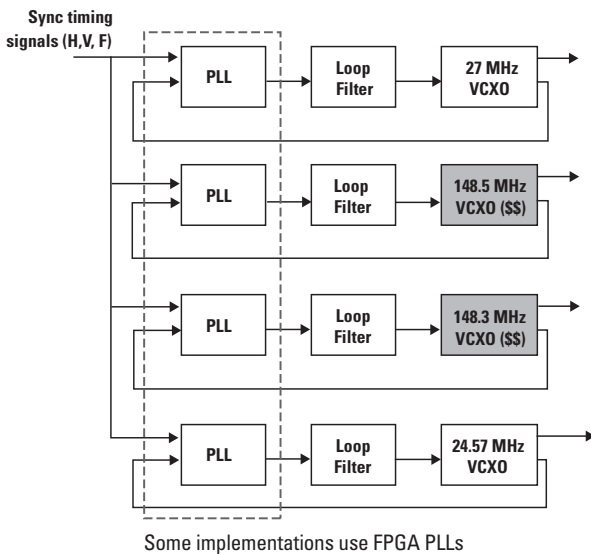
Designed for video processing cards. Dual HD clock output supports format/standards conversion and synchronous audio and video clocks support audio embed/de-embed applications.

Simplified Block Diagram

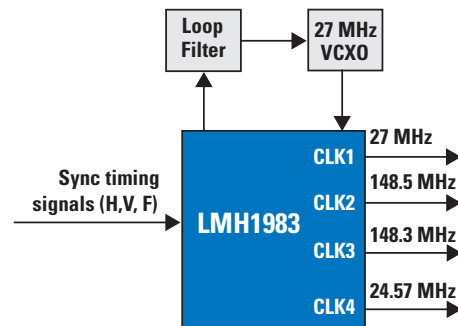


Clocking Solutions Comparison

Discrete Components – Complex, tedious, expensive



LMH1983 – Simple, elegant, clean



Video Clocking Solutions

















Sync Separators

Product ID	H Sync Slicing Type	Key Features	Supported Video Formats	Inputs	Outputs	Spec Supply Range (V)	Packaging
LMH1981 ^E	50% slicing	Auto-video format detection, 50% sync slicing, low H sync jitter,	NTSC, PAL, SECAM, 480i/p, 576i/p, 720p, 1080i/p	0.5 to 2.0 V _{P-P}	H sync, V sync, C sync, odd/even, burst/clamp, video format	3.3 to 5	TSSOP-14
LMH1980 ^E	70 mV fixed	Auto-video format detection	NTSC, PAL, SECAM, 480i/p, 576i/p, 720p, 1080i/p, PC Sync on Green	0.5 to 2.0 V _{P-P}	H sync, V sync, C sync, odd/even, burst/clamp, HD detect flag	3.3 to 5	MSOP-10

Clock Generators

Product ID	Key Features	Inputs	Inputs Reference	Outputs	Output Clock Frequencies (MHz)	Supply (V)	Packaging
LMH1982 ^E	Simultaneous SD and 3G/HD clock outputs, exceeds SMPTE jitter spec, genlock and free-run modes	2	H/V sync, and/or 27 MHz	2	SD Clock: 27 or 67.5 MHz 3G/HD Clock: 74.25, 74.25/1.001, 148.5 or 148.5/1.001 MHz	3.3 and 2.5	LLP-32
NEW LMH1983 ^E	Simultaneous SD, dual 3G/HD and audio clock outputs, low output jitter, genlock and free-run modes	1	H/V sync and/or 27 MHz	4	CLK 1: 13.5 or 27 MHz CLK2 and 3: 27, 74.25, 74.25/1.001, 148.5 or 148.5/1.001 MHz CLK4: 98.304/2 ⁿ (n=0 to 15)	3.3	LLP-40

LMK Clock Conditioner Family

Product ID	Outputs			Architecture	Output Clock Range (MHz)	VCO Frequency Range (MHz)	RMS Jitter (ps) *
	LVPECL	LVDS	LVC MOS				
LMK01000ISQ ^E	5	3	0	2:8 Clock Distribution	1 to 1600	NA	0.03 (additive)
LMK01010ISQ ^E	0	8	0		1 to 1600	NA	0.03 (additive)
LMK01020ISQ ^E	8	0	0		1 to 1600	NA	0.03 (additive)
LMK02000ISQ ^E 	5	3	0	PLL + Clock Distribution (needs external VCXO)	1 to 800	NA	0.02 (+VCXO)
LMK02002ISQ ^E 	4	0	0		1 to 860	NA	0.2 (+VCXO)
LMK03000CSQ ^E	5	3	0	PLL + VCO + Clock Distribution	1 to 648	1185 to 1296	0.4
LMK03000ISQ ^W 	5	3	0		1 to 648	1185 to 1296	0.8
LMK03000DISQ 	5	3	0		1 to 648	1185 to 1296	1.2
LMK03001CISQ ^E	5	3	0		1 to 785	1470 to 1570	0.4
LMK03001ISQ ^W 	5	3	0		1 to 785	1470 to 1570	0.8
LMK03001DISQ 	5	3	0		1 to 785	1470 to 1570	1.2
LMK03002CISQ ^E 	4	0	0		1 to 860	1566 to 1724	0.4
LMK03002ISQ 	4	0	0		1 to 860	1566 to 1724	0.8
LMK03033CISQ ^E 	4	4	0		1 to 1080	1843 to 2160	0.5
LMK03033ISQ 	4	4	0		1 to 1080	1843 to 2160	0.8
LMK03200ISQ ^E	5	3	0		1 to 1080	1185 to 1296	0.8
LMK04000BISQ ^E 	3	0	4	Cascaded PLLs + VCO + Clock Distribution (PLL1 requires external Crystal or VCXO)	1 to 648	1185 to 1296	0.15/0.2 (+VCXO/Crystal)
LMK04001BISQ ^E 	3	0	4		1 to 785	1430 to 1570	0.15/0.2 (+VCXO/Crystal)
LMK04011BISQ ^E 	5	0	0		1 to 785	1430 to 1570	0.15/0.2 (+VCXO/Crystal)
LMK04031BISQ ^E 	2	2	2		1 to 785	1430 to 1570	0.15/0.2 (+VCXO/Crystal)
LMK04002BISQ ^E 	3	0	4		1 to 875	1600 to 1750	0.15/0.2 (+VCXO/Crystal)
LMK04033BISQ ^E 	2	2	2		1 to 1080	1840 to 2160	0.15/0.2 (+VCXO/Crystal)

*Integrated from 10 kHz to 20 MHz

 PowerWise product

^E Evaluation board

Cable Extenders

For HDMI/DVI/DisplayPort Applications

Cable Extending Equalizer Family

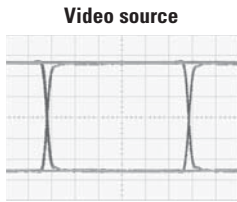
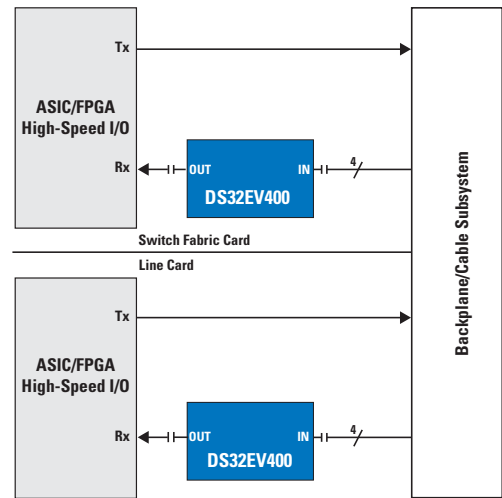
Features

- Significantly extends the reach of DVI, HDMI, and CAT5 cables
- Pin-selectable boost for equalization optimization
- Low output jitter
- Pin-selectable de-emphasis for signal conditioning optimization

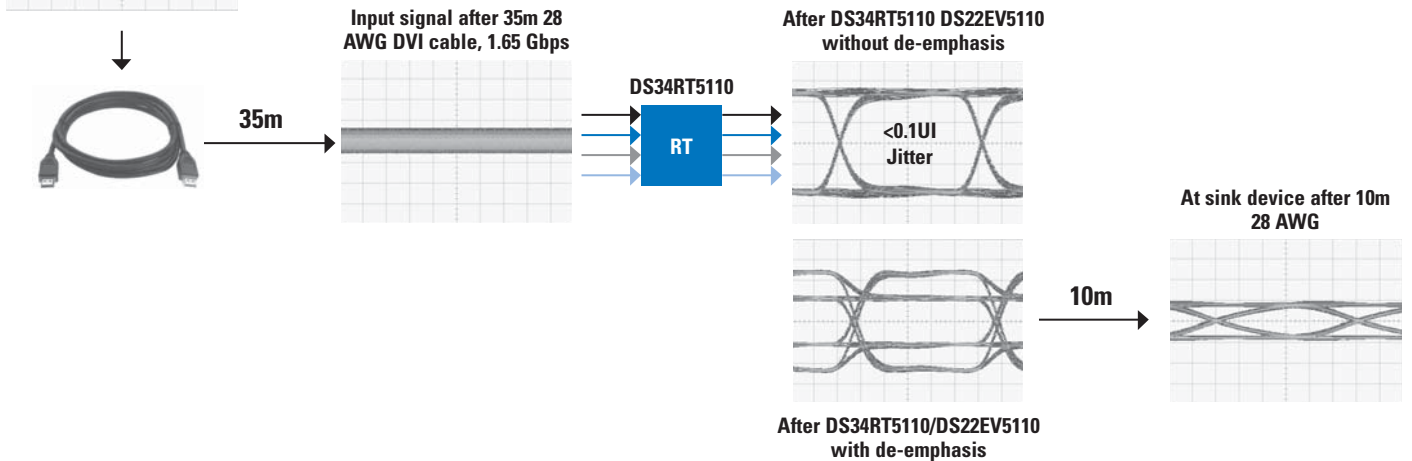
Applications

Ideal for use in HDTVs, projectors, extenders, dongles, and video capture cards/editing equipment.

Typical DisplayPort Application



HDMI/DVI Extender Application



Product ID	Function	Input Equalization	Output	Clock Rate (MHz)	Application	Comment	Packaging
HDMI							
DS16EV5110 ^E	Equalizer	8 levels, pin-selectable	HDMI	165/225	Sink	Supports 1080p applications	LLP-48
DS22EV5110 ^E	Equalizer	8 levels, pin-selectable	HDMI with de-emphasis	165/225	Source, sink	Longer reach for 1080p applications	LLP-48
DS34RT5110 ^E	Reclocking equalizer	8 levels, pin-selectable	HDMI with de-emphasis	165/225/340	Source, multi-hop, sink	Supports deeper color, higher resolutions, higher frame rate up to 1440p, multi-hop applications	LLP-48
Display Port							
NEW DS32EV400 ^E	Equalizer	8 levels, pin selectable	CML with de-emphasis	270	Sink	Supports DisplayPort v1.1	LLP-48

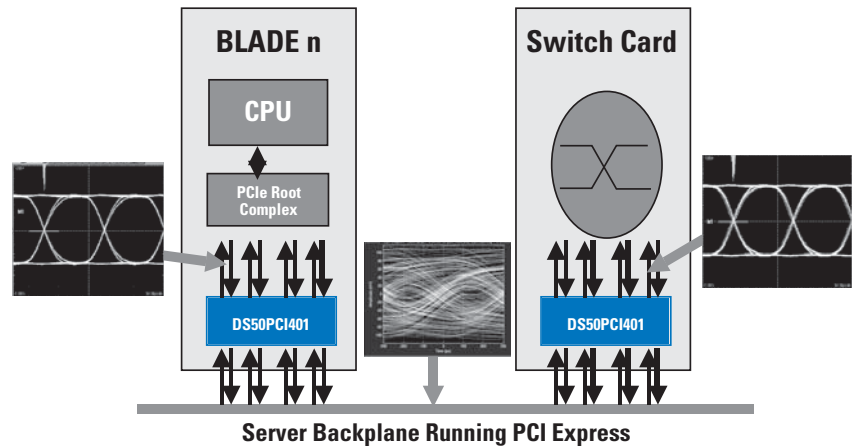
PowerWise product ^E Evaluation board

High-Speed Switching and Signal Conditioning

DS50PCI401 – PCIe Standards-Approved Gen-1 and Gen-2 Quad Transceivers

Features

- PCI-SIG approved for PCIe Gen-1 and Gen-2 applications
- Signal conditioning on receive (26 dB equalization) and transmit (12 dB de-emphasis)
- Auto rate detect and adjustment of signal-conditioning
- Gen-1 (2.5 Gbps), Gen-2 (5 Gbps)
- IDLE and receiver detect, beacon signal pass through
- Low power – 100 mW/channel, per-channel power-down option
- 0.10 UI residual DJ at 5 Gbps over 42" FR-4



Applications

Extends the reach of high-speed PCIe signals across lossy backplane and cables.

Buffers and Repeaters with LVDS Output

Product ID	Channels	I/O Compatibility	Max Speed/Ch (Gbps)	Input SigCon (Max dB)	Output SigCon (Max dB)	Power/Channel (mW)	Packaging	Configuration
DS50PCI401 ^E	8	PCIe	5	26	-12	95	LLP-54	Pin or SMBus
DS64BR401 ^E	8	LVDS/LVPECL/CML	6.4	33	-12	95	LLP-54	Pin or SMBus
DS64EV400 ^E	4	LVDS/LVPECL/CML	10	24	—	90	LLP-48	Pin or SMBus
DS42BR400 ^E	8	CML	4.2	5	-9	163	LLP-60	Fixed EQ, Pin DE
DS25BR440	4	LVDS/LVPECL/CML	3.125	5	6	134	LLP-40	Pin

Crosspoint Switches/Splitters

Product ID	Description	Control Interface	Max Speed/Ch (Gbps)	Input SigCon (Max dB)	Output SigCon (Max dB)	Power (mW)	Packaging	Comments
DS25CP104A ^E	4 x 4 LVDS crosspoint switch	Pin or SMBus	3.125	EQ	Pre-E	518	LLP-40	—
DS25CP102 ^E	2 x 2 LVDS crosspoint switch	Pin selectable	3.125	EQ	Pre-E	254	LLP-16	—
DS42MB200	Mux buffer (2:1 redundancy switch)	2 ports	4.25	EQ	Pre-E	1000	LLP-48	Loopback
DS42MB100	Mux buffer (2:1 redundancy switch)	1 port	4.25	EQ	Pre-E	450	LLP-36	Loopback
DS25BR204 ^E	1:4 LVDS repeater	2 channel	3.125	EQ	Pre-E	495	LLP-40	LVDS/LVPECL/CML to LVDS
DS10BR254	1:4 LVDS repeater	2 channel	1.5	EQ	—	373	LLP-40	LVDS/LVPECL/CML to LVDS

PowerWise® product ^E Evaluation board

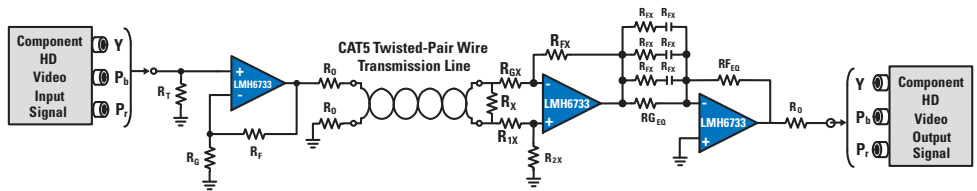
Analog Video Amplifiers and Buffers

LMH6733 – Triple Operational Amplifier with Industry’s Best Bandwidth-to-Power Ratio

Features

- 1.0 GHz -3 dB small signal bandwidth ($A_V = +1$, $V_S = \pm 5V$)
- 600 MHz -3 dB large signal bandwidth ($A_V = +2$, $V_S = \pm 5V$)
- 350 MHz 0.1 dB gain flatness
- -80 dB crosstalk at 10 MHz
- 5.5 mA/channel supply current
- Single supply operation: 3V to 12V

LMH6733 Typical Application



Applications

Optimized for use in HD component video drivers, HD video displays, flash ADC drivers, and video over twisted pair applications.

Product ID	Unity Gain BW (MHz) at AVCL (V/V)	Slew Rate (V/ μ s)	I_{CC} (mA/ch)	Supply Range (V)	NTSC Diff. G/P %/Deg.	I_{OUT} (mA) (typ.)	Settling Time (2V step) (ns to %)	Packaging
Fully Differential Amplifiers								
LMH6550 ^E	400 at 1	3000	20	4.5 to 12	—	± 75	8.0 to 0.1	SOIC-8, MSOP-8
LMH6551 ^E	370 at 1	2400	12.5	3.0 to 12	—	± 65	18 to 0.05	SOIC-8, MSOP-8
LMH6552 ^E	1500 at 1	3800	22.5	4.5 to 12	—	± 80	10 to 0.1	SOIC-8, LLP-8
NEW LMH6553 ^E	900 at 1	2300	29.5	4.5 to 12	—	120	10 to 0.1	PSOP-8, LLP-8
NEW LMH6554 ^E	2500 at 1	6200	52	4.7 to 5.3	—	90	4.0 to 0.1	FCOL-14
Consumer Video Applications								
LMH6601 ^{E, W}	250 at 1	260	9.2	2.4 to 6.0	0.06/0.23	+50/-75	70 to 0.1	SC70-6
LMH6611/12 ^E	365 at 1	460	3.2	2.7 to 11	0.05/0.05	120	60 to 0.1	TSOT23-6/SOIC-8
LMH6643/44 ^{E, W}	130 at 1	135	2.7	3.0 to 12.8	0.15/0.04	75	68 to 0.1	SOIC-8, MSOP-8/SOIC-14, TSSOP-14
LMH6657/58 ^{E, W}	270 at 1	700	6.5	3.0 to 12	0.03/0.1	110	35 to 0.1	SC70-5, SOT23-5, SOIC-8, MSOP-8
LMH6682/83 ^{E, W}	190 at 2	940	6.5	3.0 to 12	0.01/0.08	85	42 to 0.1	SOIC-8, MSOP-8, SOIC-14, TSSOP-14
High-End Professional Video Applications								
LMH6609 ^E	900 at 1	1400	7.0	± 6.6	0.01/0.026	90	15 to 0.05	SOIC-8, SOT23-5
LMH6618/19 ^{E, W}	140 at 1	57	1.35	2.7 to 11	0.1/0.1	35	90 to 0.1	TSOT-6, SOIC-8
LMH6702 ^{E, W}	1700 at 2	3100	12.5	± 5.0 to ± 6.0	0.01/0.02	80	13.4 to 0.1	SOIC-8, SOT23-5
LMH6703 ^{E, W}	1800 at 1	3300	11.5	± 5.0 to ± 6.0	0.02/0.02	90	10 to 0.1	SOIC-8, SOT23-6
LMH6715 ^{E, W}	480 at 2	1300	5.8	± 5.0 to ± 6.0	0.02/0.02	70	12 to 0.05	SOIC-8
LMH6720/22 ^{E, W}	400 at 2	1800	5.6	± 5.0 to ± 6.0	0.02/0.01	70	12 to 0.05	SOIC-8, SOT23-6
LMH6732 ^{E, W}	540 at 2	2700	9.0	± 4.5 to ± 6.0	0.02/0.01	115	18 to 0.04	SOIC-8, SOT23-6
LMH6733 ^{E, W}	1000 at 1	3750	5.5	3.0 to 12	0.03/0.025	60	10 to 0.1	SSOP-16
LMH6738 ^E	750 at 1	3300	11.6	8.0 to 12	0.02/0.01	90	13.4 to 0.1	SSOP-16
Video Buffers/Programmable Gain Buffers								
LMH6559 ^E	1750 at 1	4580	10	3.0 to 10	0.06/0.02	74	9.0 to 0.1	SOIC-8, SOT23-5
LMH6704 ^E	650 at 1	3000	11.5	8.0 to 12	0.02/0.02	90	10 to 0.1	SOIC-8, SOT23-6
LMH6739 ^E	750 at 1	3300	11.5	8.0 to 12	0.02/0.01	90	10 to 0.1	SSOP-16

Multiplexers, VGAs, and Crosspoint Switches

For Analog Video

LMH6574 – High-Performance 4:1 Multiplexer

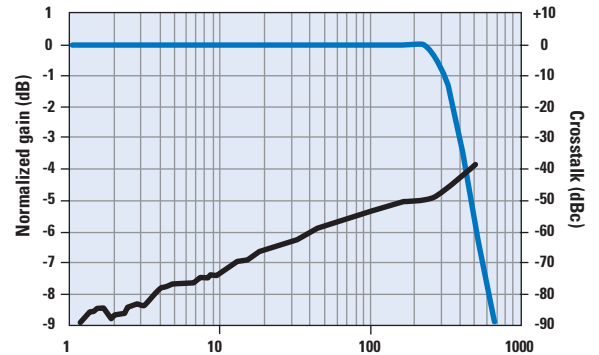
Features

- 500 MHz, 500 mV, -3 dB bandwidth, $A_V = 2$
- 0.1 dB gain flatness to 150 MHz
- 400 MHz, 2 V_{P-P}, -3 dB bandwidth, $A_V = 2$
- 8 ns channel switching time
- Shutdown allows MUX expansion

Applications

High-performance analog multiplexers are optimized for professional grade video and other high-fidelity, high-bandwidth analog applications.

LMH6574 Performance Bandwidth vs Crosstalk



Product ID	Channels	Key Features	SSBW (MHz)	Switching Speed (ns)	Crosstalk Rejection (dB)	Settling Time to 0.05% (ns)	2nd/3rd HD into $R_L=100\Omega$ (dBc)	I_{OUT} [mA] (typ.)	Supply Current I_{CC} (0.05% mA)	Supply Range (V)	Temp. Range (°C)	SPICE Model	Packaging
High-Performance Multiplexer Products													
LMH6570 ^E	2:1	Buffered, shutdown	500	8.0	70	17	-68/-84 at 5 MHz	80	13.8	±3 to ±6	-40 to 85	✓	SOIC-8
LMH6572 ^E	Triple 2:1	Buffered, 2x fixed gain, shutdown	350	10	90	17	-78/-75 at 10 MHz	80	23	±3 to ±6	-40 to 85	✓	SSOP-16
LMH6574 ^E	4:1	Buffered, selectable gain shutdown, stage disable	500	8.0	85	17	-68/-84 at 5 MHz	80	13	±3 to ±6	-40 to 85	✓	SOIC-14

Product ID	Channel	Key Features	Single Channel BW (MHz)	Control Channel BW (MHz)	Gain Adjust Range (dB)	Slew Rate SR (V/ μ s)	Supply Range Vs (V)	Supply Current Is (mA)	Common Mode Input Range CMIR (V)	Gain Response	Temp. Range (°C)	SPICE Model	Packaging
Wideband VGAs													
LMH6502 ^E	Single	Differential input	130	100	70	1800	5.0 to 12	27	±2.2	Linear-in-dB	-40 to 85	✓	SOIC-14, TSSOP-14
LMH6503 ^E	Single	Differential input	135	100	70	1800	5.0 to 12	37	±2.2	Linear-in-V/V	-40 to 85	✓	SOIC-14, TSSOP-14
LMH6505 ^E	Single	Single-ended input	150	100	80	1500	7.0 to 12	11	±3.0	Linear-in-dB	-40 to 85	✓	SOIC-8, MSOP-8

Product ID	Channels	Key Features	SSBW (MHz)	Slew Rate (V/ μ s)	Crosstalk Rejection (dB)	Settling Time	Diff. G/P %/deg. into $R_L=150\Omega$	2nd/3rd HD into $R_L=100\Omega$ (dBc)	I_{OUT} (mA) (typ.)	Temp. Range (°C)	Supply Range (V)	Packaging
High-Performance Crosspoint Switch												
LMH6585 ^E	32 x 16	2x gain, serial prog.	400	1200	-43 at 100 MHz	15 ns 2V step at 0.5%	0.04/0.03 at 3.58 MHz and 4.43 MHz	-70 at 10 MHz/ -75 at 10 MHz	±45	-40 to 85	±3.0 to ±5.0	TQFP-144
LMH6583 ^E	16 x 8	2x gain, serial prog.	550	1900	-70/-45 at 10 MHz/ 100 MHz	18 ns 2V step at 0.1%	0.04/0.04 at 3.58 MHz and 4.43 MHz	-74 at 20 MHz/ -77 at 5 MHz	±60	-40 to 85	±3.0 to ±5.0	eTQFP-64
NEW LMH6580 ^E	8 x 4	1x gain, serial prog.	450	1200	-45	6 ns	0.05/0.05 at 3.58 MHz and 4.43 MHz	-80 at 5 MHz/ -70 at 5 MHz	±70	-40 to 85	±3.0 to ±5.5	TQFP-48

Product ID	Channels	Key Features	SSBW (MHz)	LSBW (MHz)	Crosstalk Rejection (dB)	Diff. G/P %/deg. into $R_L=150\Omega$	Temp. Range (°C)	Spec. Supply	Packaging
Composite Video Crosspoint Switch									
LMH6586 ^E	32 x 16	Video clamps, loss of video det., I ² C prog.	66	29	-58 db at 6 MHz	0.05/0.05 at 3.58 MHz	-40 to 85	5V	TQFP-80

PowerWise® product ^E Evaluation board

High-Performance Audio Products

LME49713 – High-Performance, High-Fidelity Current Feedback Audio Operational Amplifier

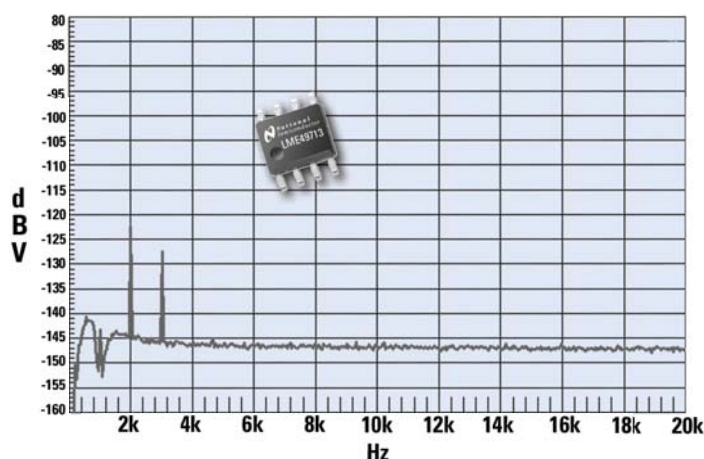
Features

- Extended dynamic range: 139 dB
- Distortion and noise <0.00008%
- +22 dBu input/output handling capability
- Slew rate: 1900 V/ μ s ensures accurate bandwidth and high dynamic range
- Operates from \pm 5V to \pm 8V

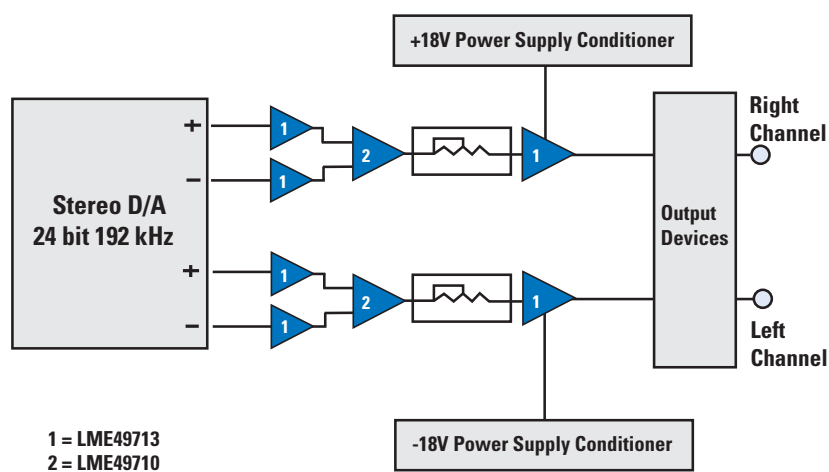
Applications

Optimized and fully specified for high-performance, high-fidelity applications like preamplifiers, multimedia, professional audio, and equalization and crossover networks.

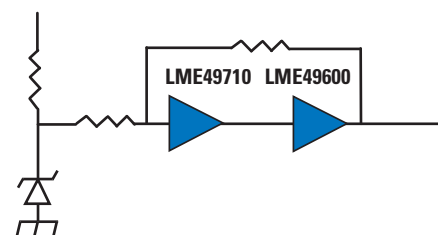
Current Feedback Op Amp FFT Plot



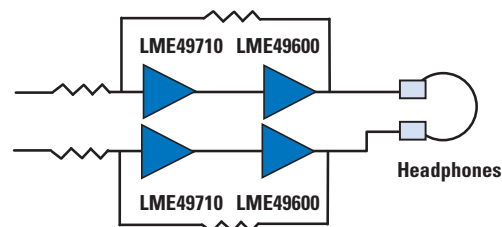
Digital-to-Analog Converter



Power Supply Voltage Conditioner



Buffer Headphone



High-Performance Audio Products

Product ID	Type	Channels	V _{CC} (V)	I _{CC} (per amp)	THD+N	Bandwidth (MHz)	Slew Rate (V/ μ s)	Noise (nV/ \sqrt Hz)	V _{OS} (mV)	I _{BIAS} (μ A)
LME49710	Variable Feedback	1	34	5 mA	0.00003%	55	20	2.5	0.1	10 nA
LME49713	Current Feedback	1	36	8 mA	0.00008%	132	1900	1.9	0.05	1.8
LME49600	Buffer	1	36	7.3 mA	0.00003%*	180	2000	2.6	17	1

* Enclosed loop with the LME49710

Hardware Monitors and Thermal Management

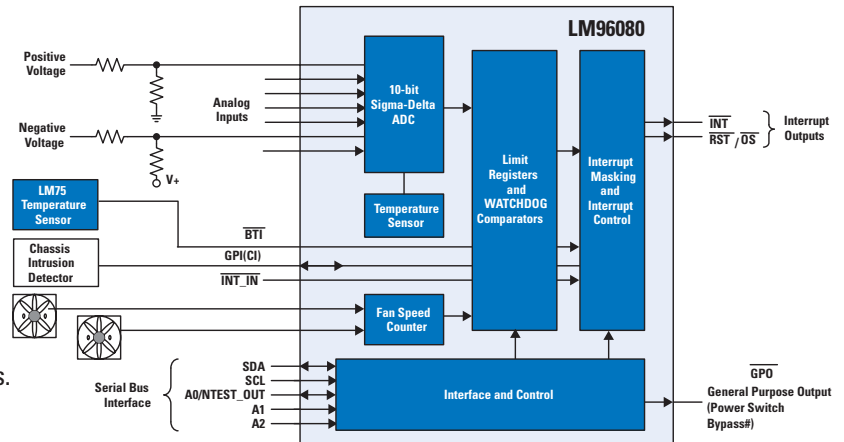
LM96080 – System Hardware Monitor with 2-Wire Serial Interface

Features

- Local temperature setting
- 7 positive voltage inputs with 10-bit resolution
- 2 programmable fan-speed monitoring inputs
- 2.5 mV LSB and 2.56V input range
- Chassis intrusion detector
- WATCHDOG comparison of all monitored values
- I²C serial bus interface compatibility
- Shutdown mode to minimize power consumption
- Software- and pin-compatible with LM80

Applications

Ideal for use in routers, switches, and encoder/decoders.



Selected Temperature Sensors

Product ID	Description	Temperature Range (°C)	Accuracy	Scale Factor / Resolution	Supply Voltage (V)	Supply Current	Packaging
Analog							
LM94022 ^E	1.5V analog temperature sensor with 4 selectable gains and class-AB output	-50° to 150°	± 1.5°C (20°C to 40°C)	-5.5 to -13.6 mV/°C	1.5 to 5.5	5.4 µA	SC-70
Digital							
LM73 ^E	11- to 14-bit, 2-wire local digital temperature sensor	-40° to 150°	± 1.0°C (-10°C to 80°C)	0.03125°C/LSB	2.7 to 5.5	320 µA	SOT23-6
LM75A ^E	9-bit digital temperature sensor and thermal watchdog with two-wire interface	-55° to 125°	± 2.0°C (-25°C to 100°C)	0.5°C/LSB	3.0 to 5.5	250 µA	MSOP-8, SOIC-8
Remote Diode							
LM95214 ^E	11-bit quad remote diode temperature sensor with SMBus interface, 3 Tcrit	-40° to 140°	±1.1°C (TA = 25°C to 85°C, TD = 60°C to 100°C)	0.03125°C/LSB	3.0 to 3.6	570 µA	LLP-14
Temperature Switches							
LM26LV ^E	1.6 V factory preset temperature switch and temperature sensor	-50° to 150°	± 2.2°C (0°C to 150°C)	—	1.6 to 5.5	8 µA	LLP-6
LM57 ^E	2.4V user programmable temperature switch and temperature sensor	-50° to 150°	±1.5, ±2.3 (-50°C to 150°C)	—	2.4 to 5.5	24 µA	LLP-8
Hardware Monitors							
NEW LM96080 ^E	10-bit ADC, 7 channels, local temp, fan TACH inputs, 2 wire I/F	-40° to 125°	± 3.0°C (-40°C to 125°C)	0.0625°C/LSB	3.0 to 5.5	0.3 mA	TSSOP-24
LM87 ^E	Dual remote diodes, DAC output, TACH inputs	-40° to 125°	± 3.0°C (TA = 60°C to 125°C)	1°C/LSB	2.8 to 3.8	0.7 mA	TSSOP-24
LM96194	4 TruTherm® RDTS, 4 fan monitors, 2 fan controls, 8 voltage monitors	-40° to 85°	± 3°C (TA = 0°C to 85°C TD = 0°C to 100°C)	0.5°C/LSB	3.0 to 3.6	1.6 mA	LLP-48
LM96163 ^E	TruTherm remote clocks and integrated fan control	-40° to 140°	±0.75°C (TA = ±25°C to 85°C TD = 50°C to 105°C)	0.125°C/LSB	3.0 to 3.6	4.56 mA	LLP-10
NEW ADC128D818 ^E	12-bit ADC, 8 single-ended or 4 pseudo-differential channels, local temp, 2 wire I/F	-40° to +125°	± 3.0°C (-40°C to 125°C)	0.0625°C/LSB	3.0V to 5.5	0.56 mA	TSSOP-16

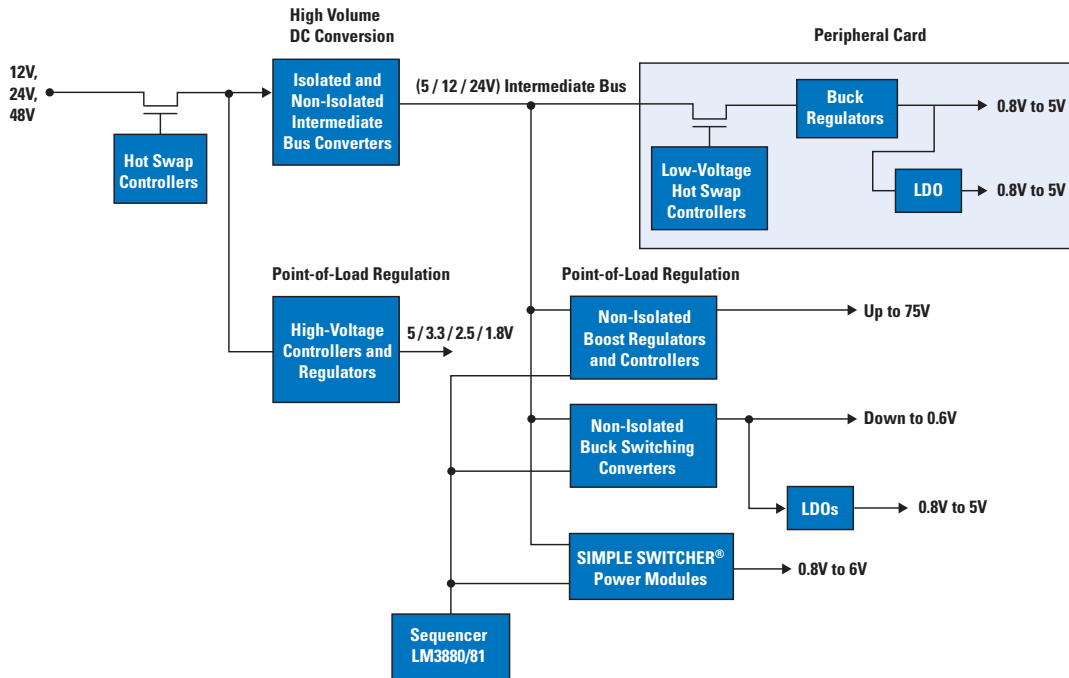
PowerWise® product ^E Evaluation board

Power Management Solutions for Broadcast Video

National's analog leadership extends into power management, with a complete portfolio of products for any broadcast video application. National's PowerWise® family spotlights innovative products with industry-leading performance and minimal power consumption. National's WEBENCH® environment

provides end-to-end design and prototyping tools to easily create power supplies to meet your design requirements. Visit national.com/webench today to design a power supply for your video application.

Power Architecture for Broadcast Video



SIMPLE SWITCHER® Buck Regulator Family

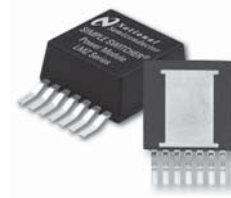
		Maximum Load Current											
		Frequency	Input Voltage (V)	0.5A	0.75A	1A	1.5A	2A	2.5A	3A	4A	5A	
Asynchronous	VM	Adj. up to 1 MHz	4.5 to 42	LM22671		LM22672		LM22680		LM22670		LM22677	
		Fixed 500 kHz	4.5 to 42	LM22674		LM22675				LM22673 LM22676		LM22678 LM22679	
	CM	Adj. up to 1 MHz	6 to 42	LM25574			LM25575				LM25576		
		Adj. up to 500 kHz	6 to 75	LM5574			LM5575				LM5576		
Synchronous	COT	Adj. up to 1 MHz	4.5 to 42		LM3103		LM3100		LM3102				
	VM	500/1500 kHz						LM2852					
		550 kHz	2.85 to 5.5							LM2853			
		500/1000 kHz									LM2854		
	COT	Adj. up to 1 MHz	6 to 42	LM3150 SIMPLE SWITCHER controller up to 12A with adjustable V _{OUT}									
	250/500/750 kHz	LM315x SIMPLE SWITCHER controller up to 12A with fixed V _{OUT}											

Asynchronous Rectification, Synchronous Rectification, CM = Current Mode Control Loop, VM = Voltage Mode Control Loop, COT = Constant On Time Control

SIMPLE SWITCHER® Power Modules

Highly Integrated Solution in Easy-to-Use Package

The SIMPLE SWITCHER® power modules deliver powerful system performance, low EMI, and high reliability enabling today's state-of-the-art broadcast video equipment up to 1080p. The power modules integrate control circuitry, a shielded inductor, MOSFETs, and small passives in an easy-to-use package to streamline design and layout challenges like choosing the inductor, selecting the switching frequency, and optimizing the switch node for thermal and EMI performance.



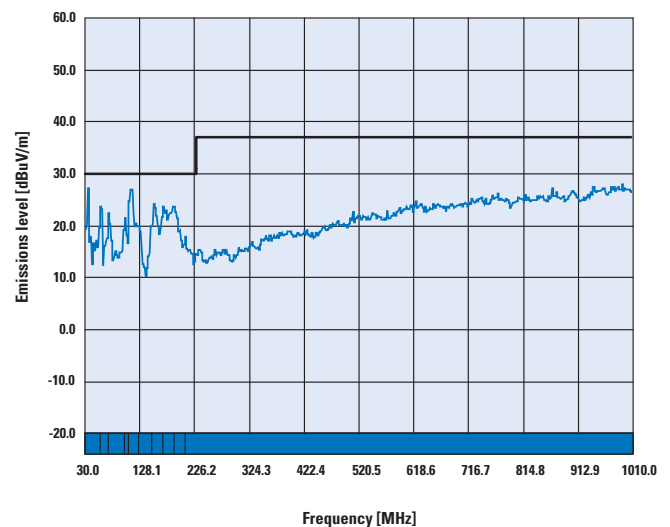
Features and Benefits

- Innovative packaging makes modules as easy to use as a Low-Dropout (LDO) Linear Regulator
- Highly integrated solution simplifies board layout and design qualification to lower manufacturing and overall risk
- Pin-to-pin compatibility and identical footprint for different load currents within each module series maximizes design reusability
- Up to 96% peak efficiency using DC-DC switching reduces system heat generation and energy costs
- Semiconductor integrated circuit-level reliability and performance for rugged environments
- Excellent thermal performance eliminates the need for external heat sinks and fans
- Guaranteed low EMI performance will not interfere with sensitive analog signal paths

Applications

Ideal for use in production switchers, routers, monitors and projectors, servers, VTRs, and encoders/decoders.

LMZ10504 Radiated EMI Performance



Complies with EN55022 (CISPR22) Class B Radiated EMI Standard

SIMPLE SWITCHER Power Modules

Series	Product ID	Output Current (A)	Input Min Voltage (V)	Input Max Voltage (V)	Output Min (V)	Output Max (V)	Freq (kHz)	Packaging
NEW 5V	LMZ10503 ^{E,W}	3	2.95	5.5	0.8	5	1000	TO-PMOD-7
	LMZ10504 ^{E,W}	4	2.95	5.5	0.8	5	1000	TO-PMOD-7
	LMZ10505 ^{E,W}	5	2.95	5.5	0.8	5	1000	TO-PMOD-7
NEW 20V	LMZ12001 ^{E,W}	1	4.5	20	0.8	6	1000 max	TO-PMOD-7
	LMZ12002 ^{E,W}	2	4.5	20	0.8	6	1000 max	TO-PMOD-7
	LMZ12003 ^{E,W}	3	4.5	20	0.8	6	1000 max	TO-PMOD-7
NEW 42V	LMZ14201 ^{E,W}	1	6	42	0.8	6	1000 max	TO-PMOD-7
	LMZ14202 ^{E,W}	2	6	42	0.8	6	1000 max	TO-PMOD-7
	LMZ14203 ^{E,W}	3	6	42	0.8	6	1000 max	TO-PMOD-7

^P PowerWise® product

^E Evaluation board

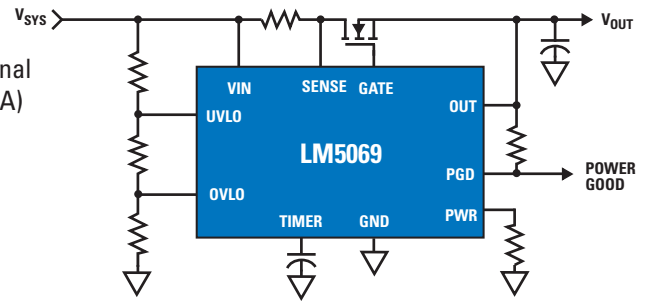
^W WEBENCH enabled

Hot Swap and PWM Controllers

LM(2)506x – Hot Swap/In-Rush Current Limit Controllers with Current and Power Limiting

Features

- In-rush current limit for safe module insertion and removal from live power sources
- Adjustable power limit sets maximum power dissipation in the external pass device and ensures MOSFET stays in Safe Operating Area (SOA)
- Programmable input Under Voltage Lockout (UVLO) and hysteresis
- Programmable input Over Voltage Lockout (OVLO) and hysteresis
- Programmable multifunction timer to prevent nuisance trips



Applications

Provides intelligent control of the power supply connections during insertion and removal of circuit cards from a live system backplane or other “hot” power sources.

Hot Swap/In-Rush Current Controllers

Product ID	V _{IN} Range	POWER GOOD	Adjustable UVLO	Adjustable OVLO	Active In-Rush Current Limit	Active Current Limiting	Active Power Limiting	Fault Latch-Off / Auto Retry	Packaging
NEW LM5060 ^E	+5.5V to +65V	V _{DS}	✓	✓	✓	—	—	✓	MSOP-10
LM5067 ^E	-9V to -80V	V _{DS}	✓	✓	✓	✓	✓	✓	MSOP-10, LLP-10
LM5069 ^E	+9 to +100V	V _{DS}	✓	✓	✓	✓	✓	✓	MSOP-10
LM25061 ^E	+2.9V to +16V	V _{OUT} (adj.)	✓	—	✓	✓	✓	✓	MSOP-10
LM25069 ^E	+2.9V to +16V	V _{DS}	✓	✓	✓	✓	✓	✓	MSOP-10

Buck Controllers

Product	Input Min Voltage (V)	Input Max Voltage (V)	# of Outputs	Output Min Voltage (V)	Output Max Voltage (V)	Frequency Range (kHz) & Sync Capability	Synchronous	PWM Mode	Packaging
NEW LM5027A ^E	13	105	1	13	105	1000	—	Voltage	eTSSOP-20
LM5035A/B/C ^E	13	105	1	13	105	2000	✓	Voltage, Current	LLP-24, eTSSOP-20
LM5116 ^E	6	100	1	1.215	80	50 to 1000, Sync	✓	Emulated Peak Current Mode (ECM)	eTSSOP-20
LM5085 ^E	4.5	75	1	1.25	75	50 to 1000	—	Constant on-time	LLP-8, MSOP-8, eMSOP-8
LM5088 ^{EW}	4.5	75	1	1.2	70	50 to 1000, Sync	—	Constant on-time	eTSSOP-16
LM5118 ^{EW}	3	75	1	1.23	70	50 to 500, Sync	—	Emulated Peak Current Mode (ECM)	eTSSOP-20
LM5115/A ^E	4.5	75	1 or 2	0.75	13.5	50 to 1000, Sync	✓	Voltage/Current-injection Valley Current Mode	TSSOP-16
LM25085/A ^E	4.5	42	1	1.25 / 0.9	42	50 to 1000	—	Constant on-time	LLP-8, MSOP-8, eMSOP-8
LM25088 ^{EW}	4.5	42	1	1.2	40	50 to 1000, Sync	—	Constant on-time	eTSSOP-16
LM25115/A	4.5	42	1 or 2	0.75	13.5	100 to 1000, Sync	✓	SSPR, Voltage/Current-injection	TSSOP-16
LM25116 ^E	6	42	1	1.215	36	50 to 1000, Sync	✓	Emulated Peak Current Mode (ECM)	eTSSOP-20
LM3150 ^{EW}	6	42	1	0.6	40	1000	✓	Constant on-time	TSSOP-14
NEW LM27402 ^E	3	20	1	0.6	19	200 to 1200	✓	Voltage with feedforward	TSSOP-16

PowerWise product

^E Evaluation board

^W WEBENCH enabled

Synchronous Switching Controllers and Regulators

LM315x – SIMPLE SWITCHER® Synchronous Controllers

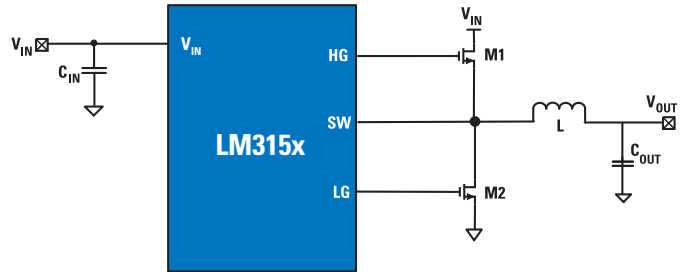
Features

- Input voltage ranging from 6V to 42V
- Output current up to 12A
- Constant On-Time control eliminates the need for complex compensation circuitry
- Patent-pending emulated ripple mode allows for the use of low-ESR output capacitors for reduced solution size and reduced output voltage ripple
- Synchronous architecture for added efficiency

Applications

Ideal for use in 12V and 24V intermediate rail conversions.

Typical Application Circuit



LM315x Family of SIMPLE SWITCHER Controllers

Product ID	Input Max (V)	Input Min (V)	Output Min (V)	Output Max (V)	Feedback Tolerance %	Frequency Range (KHz) and Sync	Packaging
LM3150 ^{E, W}	42	6	0.6	Adj	1.50	Adj to 1 MHz	eTSSOP-14
LM3151 ^{E, W}	42	6	3.3	3.3	1.50	250	eTSSOP-14
LM3152 ^{E, W}	33	6	3.3	3.3	1.50	500	eTSSOP-14
LM3153 ^{E, W}	18	6	3.3	3.3	1.50	750	eTSSOP-14







High-Current Synchronous Step-Down Switching Regulators

Product ID	Input Max Voltage (V)	Input Min Voltage (V)	Output Min (V)	Output Max (V)	Output Current (mA)	Frequency Range (KHz) & Sync Capability	On/Off Pin	PWM Mode	Packaging
LM20242 ^E	36	4.5	0.8	32	2000	Adj. to 1000	✓	Current	eTSSOP-20
LM20123 ^{E, W}	5.5	2.95	0.8	5.0	3000	1500, Fixed	✓	Current	eTSSOP-16
LM20133 ^{E, W}	5.5	2.95	0.8	5.0	3000	460 to 1500, Sync	✓	Current	eTSSOP-16
LM20143 ^{E, W}	5.5	2.95	0.8	5.0	3000	500 to 1500	✓	Current	eTSSOP-16
LM20323 ^{E, W}	36	4.5	0.8	32	3000	500, Fixed	✓	Current	eTSSOP-20
LM20333 ^{E, W}	36	4.5	0.8	32	3000	200 to 1500, Sync	✓	Current	eTSSOP-16
LM20343 ^{E, W}	36	4.5	0.8	32	3000	250 to 1000, Sync	✓	Current	eTSSOP-20
LM20134 ^{E, W}	5.5	2.95	0.8	5.0	4000	460 to 1500, Sync	✓	Current	eTSSOP-16
LM20144 ^{E, W}	5.5	2.95	0.8	5.0	4000	Adj. to 1000	✓	Current	eTSSOP-16
LM20154 ^{E, W}	5.5	2.95	0.8	5.0	4000	1000, Fixed	✓	Current	eTSSOP-16
LM20125 ^{E, W}	5.5	2.95	0.8	5.0	5000	500, Fixed	✓	Current	eTSSOP-16
LM20145 ^{E, W}	5.5	2.95	0.8	5.0	5000	250 to 750	✓	Current	eTSSOP-16
^{NEW} LM21305 ^E	18	3.0	0.6	5.0	5000	300 to 1500, Sync	—	Current	LLP-28
LM20136 ^{E, W}	5.5	2.95	0.8	5.0	6000	460 to 750, sync	✓	Current	eTSSOP-16
LM20146 ^{E, W}	5.5	2.95	0.8	5.0	6000	250 to 750	✓	Current	eTSSOP-16











^W PowerWise® product ^E Evaluation board ^W WEBENCH enabled

Synchronous Buck Switching Regulators

SIMPLE SWITCHER® Synchronous Buck Regulators

Product ID	Input Max Voltage (V)	Input Min Voltage (V)	Output Min (V)	Output Max (V)	Output Current (mA)	Frequency Range (kHz)	PWM Mode	Packaging
LM3103 ^{E, W} 	42	4.5	0.6	38	750	1000	COT	eTSSOP-16
LM3100 ^{E, W} 	36	4.5	0.8	32	1500	1000	COT	eTSSOP-20
LM2852 ^{E, W} 	5.5	2.85	0.8	3.3	2000	500, 1500	Voltage	TSSOP-14
LM3102 ^{E, W} 	42	4.5	0.8	38	2500	1000	COT	eTSSOP-20
LM2853 ^{E, W} 	5.5	3	0.8	3.3	3000	550	Voltage	TSSOP-14
LM2854 ^{E, W} 	5.5	2.95	0.8	V _{IN}	4000	500, 1000	Voltage	eTSSOP-16

Synchronous Buck Regulators

Product ID	Input Max Voltage (V)	Input Min Voltage (V)	Output Min (V)	Output Max (V)	Output Current (mA)	Frequency Range (kHz) & Sync (computed field)	On/Off Pin	PWM Mode	Packaging
LM3670 ^{E, W} 	5.5	2.5	0.7	3.3	350	1000	✓	Voltage with input feedforward	SOT23-5
LM3673 ^{E, W} 	5.5	2.7	1.1	3.3	350	2000	✓	Voltage with input feedforward	micro SMD-5
LM3679 ^E 	5.5	2.5	1.2	1.8	350	3000	✓	Auto	micro SMD-5
LM3671 ^{E, W} 	5.5	2.7	1.1	3.3	600	2000	✓	Voltage with input feedforward	SOT23-5, LLP-6, micro SMD-5
LM3674 ^{E, W} 	5.5	2.7	1.0	3.3	600	2000	✓	Voltage with input feedforward	SOT23-5
LM3676 ^E	5.5	2.9	1.1	3.3	600	2000	✓	Voltage with input feed forward	LLP-8
LM3677 ^E 	5.5	2.7	1.2	3.3	600	3000	✓	Voltage with input feedforward	micro SMD-5
LM3218** 	5.5	2.7	0.8	3.6	650	2000	✓	Current	LTCC-8
LM3691 ^E 	5.5	2.3	0.75	1.8	1000	4000	✓	Voltage with input feedforward	micro SMD-6
LP3907* ^E	5.5	2.8	0.8	3.5	1000, 600	2100	✓	Voltage	LLP-24, micro SMD-25
LM2651 ^E	14	4	1.24	13	1500	3000	✓	Current	TSSOP-16
LM3678 ^E 	5.5	2.5	0.8	3.3	1500	3300	✓	PWM only	LLP-10
LM26480* ^E	5.5	2.8	0.8	3.3	1500 per channel	2000	✓	Voltage	LLP-24
LM26420 ^E 	6.6	3	0.8	4.5	2000 per channel	660, 2200	✓	Current	eTSSOP-20, LLP-16



* Includes 2 integrated LDO regulators

** Integrated 2.6 µH inductor






 PowerWise® product ^E Evaluation board ^W WEBENCH enabled

Non-Synchronous Buck Switching Regulators

SIMPLE SWITCHER® Non-Synchronous Step-Down Regulators

Product ID	Input Max Voltage (V)	Input Min Voltage (V)	Output Min (V)	Output Max (V)	Output Current (mA)	Frequency Range (kHz) and Sync	PWM Mode	Packaging
LM22671/74 ^{E, W}	42	4.5	1.285	35	500	500 to 1000, Adj	Voltage	PSOP-8
LM22672/75 ^{E, W}	42	4.5	1.285	35	1000	500 to 1000, Adj	Voltage	PSOP-8
LM22680 ^{E, W}	42	4.5	1.285	35	2000	500 to 1000, Adj	Voltage	PSOP-8
LM22670/73/76 ^{E, W}	42	4.5	1.285	35	3000	500 to 1000, Adj	Voltage	TO263-7 Thin, PSOP-8
LM22677/78/79 ^{E, W}	42	4.5	1.285	35	5000	500 to 1000, Adj	Voltage	TO263-7 Thin
LM2671/72/74/75 ^{E, W}	40	6.5	1.23	37	500 (LM2671/74) 1000 (LM2672/75)	260, Sync (LM2671/2)	Voltage with V _{IN} Feedforward	MDIP-8, LLP-16, SO-8
LM2670/73/76/77/78/79 ^{E, W}	40	8.0	1.23	37	3000 (LM2670/73/76) 5000 (LM2677/78/79)	260, Sync (LM2670/7)	Voltage with V _{IN} Feedforward	TO263-7, LLP-14, TO220-9
LM25574/75/76 ^{E, W} 	42	6.0	1.23	40	500 / 1500 / 3000	50 to 1000, Sync	Current	TSSOP-16 / eTSSOP-16 / eTSSOP-20
LM5574/75/76 ^{E, W} 	75	6.0	1.23	70	500 / 1500 / 3000	500, Sync	Current	TSSOP-16 / eTSSOP-16 / eTSSOP-20

Non-Synchronous Step-Down Switching Regulators

Product ID	Input Max Voltage (V)	Input Min Voltage (V)	Output Min (V)	Output Max (V)	Output Current (mA)	Frequency Range (kHz) and Sync	On/Off Pin	PWM Mode	Packaging
LM2841/42 ^E	42	4.5	0.765	34	300/600	550 to 1250	✓	Current	TSOT-6
LM5008/09A ^{E, W} 	95	6.0	2.5	75/85	350/150	50 to 600	—	Constant on-time	LLP-8, MSOP-8
LM(2)5007 ^{E, W}	42/75	9.0	2.5	70/37	500	50 to 800	—	Constant on-time	MSOP-8
LM2694 ^E	30	8.0	2.5	24	600	50 to 1000	—	Hysteretic	LLP-10, TSSOP-14
LM34919B ^E	40	6.0	2.5	35	600	2600	—	Constant on-time	micro SMD-10
LM2736 ^{E, W}	18	3.0	1.25	16	750	550, 1600	✓	Current	SOT23-6
LM2830 ^W	5.5	3.0	0.6	4.5	1000	1600, 3000	✓	Current	SOT23-5
LM2734/Z ^{E, W}	20	3.0	0.8	18	1000	550, 1600/3000	✓	Current	SOT23-6, LLP-6
LM34930 ^E 	30	8.0	2.5	30	1000	up to 2000	—	Constant on-time	micro SMD-12
LM(2)5010A ^{E, W}	75/42	6.0	2.5	70/37	1000	50 to 1000	—	Constant on-time	LLP-10, eTSSOP-14
LM2695 ^E	30	8.0	2.5	24	1250	50 to 800	—	Hysteretic	LLP-10, eTSSOP-14
LM34917A ^E 	33	8.0	2.5	30	1250	2000	—	Constant on-time	micro SMD-12
LM34914 ^E	40	8.0	2.5	37	1250	1300	—	Constant on-time	LLP-10
LM2831 ^{E, W}	5.5	3.0	0.6	4.5	1500	550, 1600, 3000	✓	Current	SOT23-5
LM2738 ^E	20	3.0	0.8	18	1500	500, 1600	✓	Current	LLP-8, eMSOP-8
LM26001 ^E 	38	3.0	1.25	35	1500	150 to 1000, Sync	✓	Current	TSSOP-16
LM27341/12 ^E	20	3.0	1.0	18	1500/2000	1000 to 2350, Sync	✓	Current	LLP-10, eMSOP-10
LM2832 ^{E, W}	5.5	3.0	0.6	4.5	2000	550, 1600, 3000	✓	Current	LLP-6, eMSOP-8
LM25011 ^E	42	6.0	2.51	40	2000	2000	—	Constant on-time	mini SOIC-10
LM5005/25005 ^{E, W}	75/42	7.0	1.23	70/40	2500	50 to 500, Sync 50 to 1000, Sync	—	Current	TSSOP-20
LM2833 ^E	5.5	3.0	0.6	4.5	3000	3000	✓	Current	LLP-10, eMSOP-10
LM2696 ^{E, W}	24	4.5	1.29	20	3000	100 to 500	—	Constant on-time	TSSOP-16
LM26003 ^E 	38	3.0	1.25	35	3000	150 to 500, Sync	✓	Current	TSSOP-20

 PowerWise® product ^E Evaluation board ^W WEBENCH enabled

Low-Dropout (LDO) Linear Regulators

LP5900 – Low-Noise 150 mA CMOS LDO Regulators

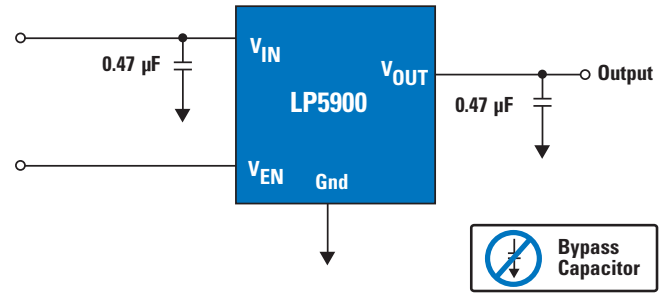
Features

- Industry's lowest noise (6.5 μVRMS) combined with 85 dB of power supply ripple rejection (PSRR) guarantees signal integrity
- 25 μA I_q minimizes current drain when system operates in low-power mode
- Elimination of bypass capacitor reduces BOM to only two ceramic 0.47 μF capacitors

Applications

Ideally suited for ultra low-noise, high PSRR point-of-load regulation for analog loads where small solution size is key.

Typical Application Circuit



Low-Dropout (LDO) Linear Regulators

Product ID	Load Current (mA)	V_{IN} Min (V)	V_{IN} Max (V)	V_{OUT} (V)	Packaging
LP38511	800	2.25	5.5	1.8, Adj down to 0.8V	T0263-5
LP38851	800	1.2	5.5	0.8 to 1.8V, Adj	PSOP-8
LP38690	1000	3.95	10	1.25V to 9V, Adj	TO-252
LP38692	1000	3.75	10	1.25V to 9V, Adj	LLP-6
LP38512	1500	2.25	5.5	1.8, Adj down to 0.8V	T0263, LLP-8
LP38500	1500	2.7	5.5	0.6V to 5V, Adj	TO-263
LP38502	1500	2.7	5.5	0.6V to 5V, Adj	TO-263
LP38852	1500	1.2	5.5	0.8 to 1.8V, Adj	T0220-7
LP38855	1500	1.38	5.5	1.2 to 1.8V, Adj	T0220-7
LP38858	1500	1.38	5.5	1.2 to 1.8V, Adj	T0220-7
LP38513	3000	2.25	5.5	1.8, Adj down to 0.8V	T0263-5
LP38501	3000	2.7	5.5	0.6V to 5V, Adj	TO-263 Thin
LP38503	3000	2.7	5.5	0.6V to 5V, Adj	TO-263 Thin
LP38853 ^E	3000	1.2	5.5	0.8 to 1.8V, Adj	PSOP-8
LP38856 ^E	3000	1.15	5.5	0.8 to 1.8V, Adj	T0263-7
LP38859 ^E	3000	1.55	5.5	1.2 to 1.8V, Adj	T0220-7

Low-Noise, Low-Power Linear Regulators

Product ID	Output Current (mA)	Input Max Voltage (V)	Input Min Voltage (V)	Dropout Voltage (V)	Output Voltage (V)	On/Off Pin	Quiescent Current (mA)	PSRR (dB)	Voltage Noise (μVRMS)	Packaging
LP3995	150	6	2.5	0.06	3, 2.8, 1.9	—	0.085	60	25	micro SMD-5, LLP-6
LP3999	150	6	2.5	0.06	1.5, 2.4, 1.8, 2.5, 2.8, 3.3	—	0.085	60	30	micro SMD-5
LP5900	150	5.5	2.5	0.08	1.5, 2.8, 3.3	—	0.025	75	6.5	micro SMD-4
LP5990 ^E	200	5.5	2.2	0.15	0.8 to 3.6	—	0.03	55	60	micro SMD-4
LP8900*	200 per channel	5.5	1.8	0.055	1.2 to 3.6	✓	0.085	75	6.0	micro SMD-6
LP3871/74	800	7	2.5	0.24	5, 1.8, 2.5, 3.3	✓	6	73	150	TO-263-5, SOT-223-5, TO-220-5
LP3878	800	16	2.5	0.475	Adj	✓	0.18	60	18	LLP-8, PSOP-8
LP3879	800	6	2.5	—	1.2, 1	✓	0.1	60	18	LLP-8, PSOP-8
LP3875	1500	7	2.5	0.38	1.8, 2.5, 3.3	✓	6	73	150	TO-263-5, SOT-223-5
LP3876	3000	7	2.5	0.8	2.5, Adj.	✓	6	73	150	TO-263-5

*Dual output ^EEvaluation board

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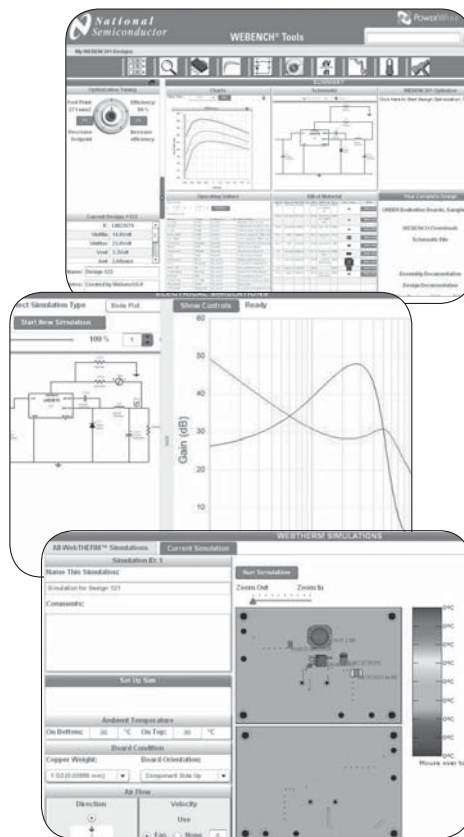
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Choose from only those parts that meet your specifications

Design It

- Tune your design quickly with the optimization tool to balance design objectives for efficiency and footprint
- Adjust components and use charts to make design decisions based on power dissipation, current flow, offset voltage, drift, frequency response, output-voltage ripple, efficiency, inductor-current ripple, and other electrical characteristics over the full operating range
- Exchange parts and use bill of materials graph for easy external component selection based on efficiency, footprint, cost, or vendors

Create your custom BOM using readily available parts



Analyze It

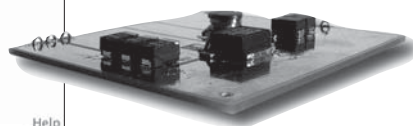
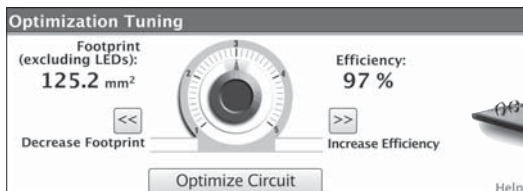
- Simulate your circuit and evaluate performance using electrical and thermal simulations
- Simulate electrical characteristics, choose probe points, and examine waveforms to determine performance
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World Headquarters

2900 Semiconductor Drive
Santa Clara, CA 95051
USA
+1 408 721 5000
national.com

Mailing Address:

PO Box 58090
Santa Clara, CA 95052
support@nsc.com

European Headquarters

Livry-Gargan-Str. 10
82256 Fürstenfeldbruck
Germany
+49 8141 35 0
europe.support@nsc.com

Asia Pacific Headquarters

2501 Miramar Tower
1 Kimberley Road
Tsimshatsui, Kowloon
Hong Kong
+852 2737 1800
ap.support@nsc.com

Japan Headquarters

Beside KIBA
2-17-16
Kiba, Koto-ku
Tokyo, 135-0042, Japan
+81 3 5639 7300
jpn.feedback@nsc.com

