

LMH0302

LMH0302 3Gbps HD/SD SDI Cable Driver



Literature Number: SNLS247F

LMH0302

3Gbps HD/SD SDI Cable Driver

General Description

The LMH0302 3Gbps HD/SD SDI Cable Driver is designed for use in SMPTE 424M, SMPTE 292M, SMPTE 344M, and SMPTE 259M serial digital video applications. The LMH0302 drives 75Ω transmission lines (Belden 1694A, Belden 8281, or equivalent) at data rates up to 2.97 Gbps.

The LMH0302 provides two selectable slew rates for SMPTE 259M and SMPTE 424M / 292M compliance. The output driver may be powered down via the output driver enable pin.

The LMH0302 is powered from a single 3.3V supply. Power consumption is typically 125 mW in SD mode and 165 mW in HD mode. The LMH0302 is available in a 16-pin LLP package.

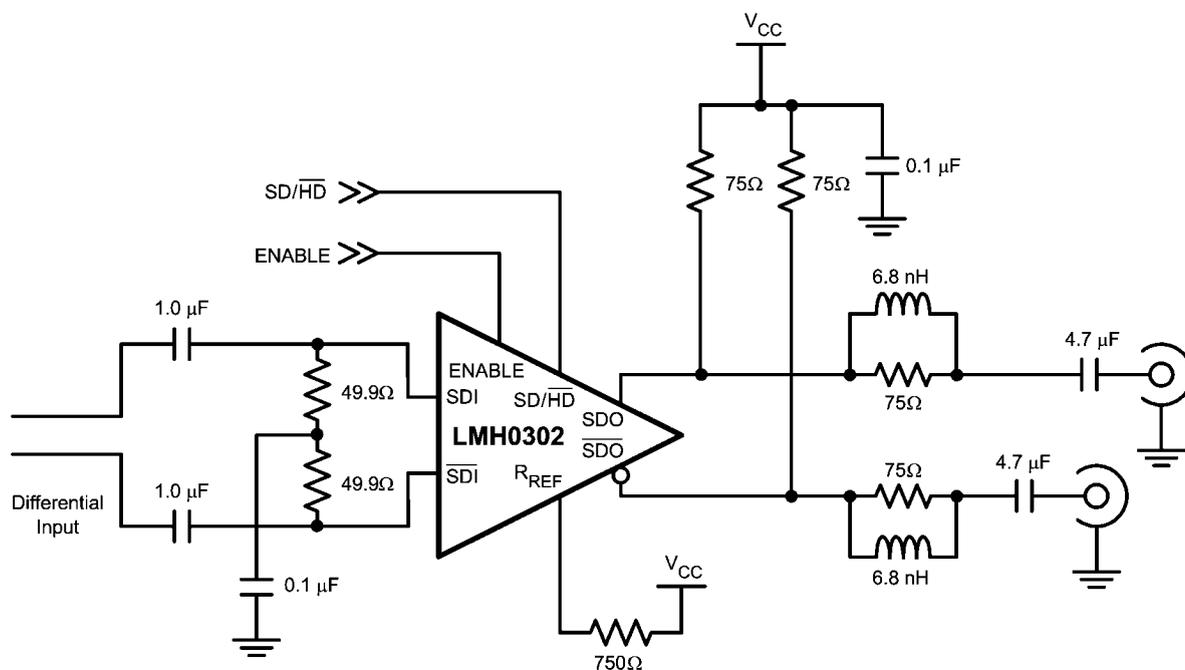
Features

- SMPTE 424M, SMPTE 292M, SMPTE 344M, and SMPTE 259M compliant
- Data rates to 2.97 Gbps
- Supports DVB-ASI at 270 Mbps
- Differential input
- 75Ω differential output
- Selectable slew rate
- Output driver power down control
- Single 3.3V supply operation
- Industrial temperature range: -40°C to +85°C
- Typical power consumption: 125 mW in SD mode and 165 mW in HD mode
- 16-pin LLP package
- Footprint compatible with the LMH0002SQ
- Replaces the Gennum GS2978

Applications

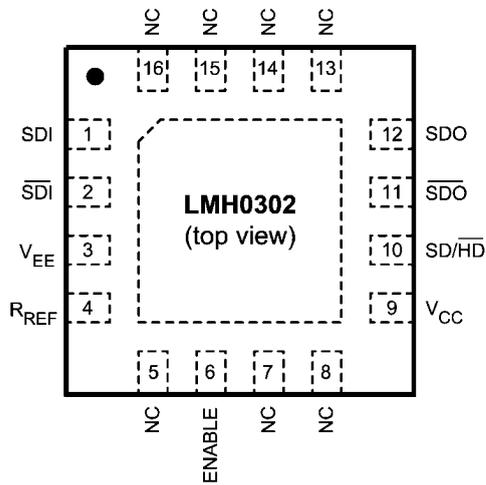
- SMPTE 424M, SMPTE 292M, SMPTE 344M, and SMPTE 259M serial digital interfaces
- Digital video routers and switches
- Distribution amplifiers

Typical Application



20214602

Connection Diagram



20214605

The exposed die attach pad is a negative electrical terminal for this device. It should be connected to the negative power supply voltage.

16-Pin LLP
Order Number LMH0302SQ
NS Package Number SQB16A

Ordering Information

Part Number	Package	Quantity
LMH0302SQ	16-Pin LLP, 4.0 x 4.0 x 0.8 mm, 0.65 mm pitch	Reel of 1000
LMH0302SQE	16-Pin LLP, 4.0 x 4.0 x 0.8 mm, 0.65 mm pitch	Reel of 250
LMH0302SQX	16-Pin LLP, 4.0 x 4.0 x 0.8 mm, 0.65 mm pitch	Reel of 4500

Pin Descriptions

Pin	Name	Description
1	SDI	Serial data true input.
2	$\overline{\text{SDI}}$	Serial data complement input.
3	V_{EE}	Negative power supply (ground).
4	R_{REF}	Output driver level control. Connect a resistor to V_{CC} to set output voltage swing.
5	NC	No connect. Not bonded internally.
6	ENABLE	Output driver enable. When low, the SDO/ $\overline{\text{SDO}}$ output driver is powered off. ENABLE has an internal pullup.
7	NC	No connect. Not bonded internally.
8	NC	No connect. Not bonded internally.
9	V_{CC}	Positive power supply (+3.3V).
10	SD/HD	Output slew rate control. Output rise/fall time complies with SMPTE 424M / 292M when low and SMPTE 259M when high.
11	$\overline{\text{SDO}}$	Serial data complement output.
12	SDO	Serial data true output.
13	NC	No connect. Not bonded internally.
14	NC	No connect. Not bonded internally.
15	NC	No connect. Not bonded internally.
16	NC	No connect. Not bonded internally.
DAP	V_{EE}	Connect exposed DAP to negative power supply (ground).

Absolute Maximum Ratings (Note 1)

Supply Voltage:	-0.5V to 3.6V
Input Voltage (all inputs)	-0.3V to $V_{CC}+0.3V$
Output Current	28 mA
Storage Temperature Range	-65°C to +150°C
Junction Temperature	+125°C
Lead Temperature (Soldering 4 Sec)	+260°C
Package Thermal Resistance	
θ_{JA} 16-pin LLP	+58°C/W
θ_{JC} 16-pin LLP	+21°C/W

ESD Rating (HBM)	4.5 kV
ESD Rating (MM)	250V
ESD Rating (CDM)	2 kV

Recommended Operating Conditions

Supply Voltage ($V_{CC} - V_{EE}$):	3.3V \pm 5%
Operating Free Air Temperature (T_A)	-40°C to +85°C

DC Electrical Characteristics

Over Supply Voltage and Operating Temperature ranges, unless otherwise specified (Note 2, Note 3).

Symbol	Parameter	Conditions	Reference	Min	Typ	Max	Units
V_{CMIN}	Input Common Mode Voltage		SDI, \overline{SDI}	1.1 + $V_{SDI}/2$		$V_{CC} -$ $V_{SDI}/2$	V
V_{SDI}	Input Voltage Swing	Differential		100		2200	mV _{P-P}
V_{CMOUT}	Output Common Mode Voltage		SDO, \overline{SDO}		$V_{CC} -$ V_{SDO}		V
V_{SDO}	Output Voltage Swing	Single-ended, 75 Ω load, $R_{REF} = 750\Omega$ 1%		720	800	880	mV _{P-P}
V_{IH}	Input Voltage High Level		SD/ \overline{HD} ,	2.0			V
V_{IL}	Input Voltage Low Level		ENABLE			0.8	V
I_{CC}	Supply Current	SD/ $\overline{HD} = 0$, SDO/ \overline{SDO} enabled			50	59	mA
		SD/ $\overline{HD} = 0$, SDO/ \overline{SDO} disabled			26	33	mA
		SD/ $\overline{HD} = 1$, SDO/ \overline{SDO} enabled			38	48	mA
		SD/ $\overline{HD} = 1$, SDO/ \overline{SDO} disabled			15	22	mA

AC Electrical Characteristics

Over Supply Voltage and Operating Temperature ranges, unless otherwise specified (*Note 3*).

Symbol	Parameter	Conditions	Reference	Min	Typ	Max	Units
DR_{SDI}	Input Data Rate		SDI, \overline{SDI}			2970	Mbps
t_{jit}	Additive Jitter	2.97 Gbps	SDO, \overline{SDO}		20		ps _{P-P}
		1.485 Gbps			18		ps _{P-P}
		270 Mbps			15		ps _{P-P}
t_r, t_f	Output Rise Time, Fall Time	$SD/\overline{HD} = 0, 20\% - 80\%$,			90	130	ps
		$SD/\overline{HD} = 1, 20\% - 80\%$		400		800	ps
	Mismatch in Rise/Fall Time	$SD/\overline{HD} = 0$				30	ps
		$SD/\overline{HD} = 1$				50	ps
	Duty Cycle Distortion	$SD/\overline{HD} = 0, 2.97$ Gbps, (<i>Note 4</i>)				27	ps
		$SD/\overline{HD} = 0, 1.485$ Gbps, (<i>Note 4</i>)				30	ps
		$SD/\overline{HD} = 1, (Note 4)$				100	ps
t_{OS}	Output Overshoot	$SD/\overline{HD} = 0, (Note 4)$				10	%
		$SD/\overline{HD} = 1, (Note 4)$				8	%
RL_{SDO}	Output Return Loss	5 MHz - 1.5 GHz, (<i>Note 5</i>)		15			dB
		1.5 GHz - 3.0 GHz, (<i>Note 5</i>)		10			dB

Note 1: "Absolute Maximum Ratings" are those parameter values beyond which the life and operation of the device cannot be guaranteed. The stating herein of these maximums shall not be construed to imply that the device can or should be operated at or beyond these values. The table of "Electrical Characteristics" specifies acceptable device operating conditions.

Note 2: Current flow into device pins is defined as positive. Current flow out of device pins is defined as negative. All voltages are stated referenced to $V_{EE} = 0$ Volts.

Note 3: Typical values are stated for $V_{CC} = +3.3V$ and $T_A = +25^\circ C$.

Note 4: Specification is guaranteed by characterization.

Note 5: Output return loss is dependent on board design. The LMH0302 meets this specification on the SD302 evaluation board.

Device Operation

INPUT INTERFACING

The LMH0302 accepts either differential or single-ended input. The inputs are self-biased, allowing for simple AC or DC coupling. DC-coupled inputs must be kept within the specified common-mode range.

OUTPUT INTERFACING

The LMH0302 uses current mode outputs. Single-ended output levels are 800 mV_{P-P} into 75Ω AC-coupled coaxial cable with an R_{REF} resistor of 750Ω. The R_{REF} resistor is connected between the R_{REF} pin and V_{CC}. The only resistor value that should be used for R_{REF} is 750Ω.

The R_{REF} resistor should be placed as close as possible to the R_{REF} pin. In addition, the copper in the plane layers below

the R_{REF} network should be removed to minimize parasitic capacitance.

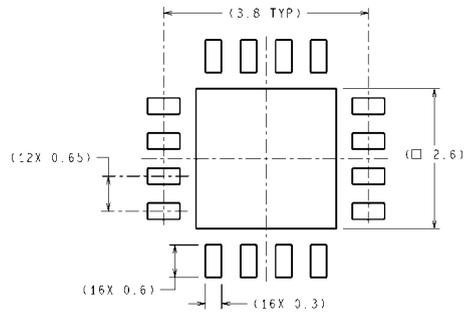
OUTPUT SLEW RATE CONTROL

The LMH0302 output rise and fall times are selectable for either SMPTE 259M or SMPTE 424M / 292M compliance via the SD/ $\overline{\text{HD}}$ pin. For slower rise and fall times, or SMPTE 259M compliance, SD/ $\overline{\text{HD}}$ is set high. For faster rise and fall times, or SMPTE 424M and SMPTE 292M compliance, SD/ $\overline{\text{HD}}$ is set low.

OUTPUT ENABLE

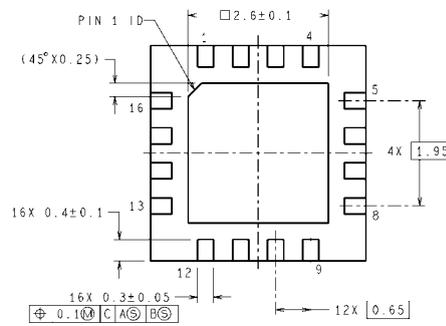
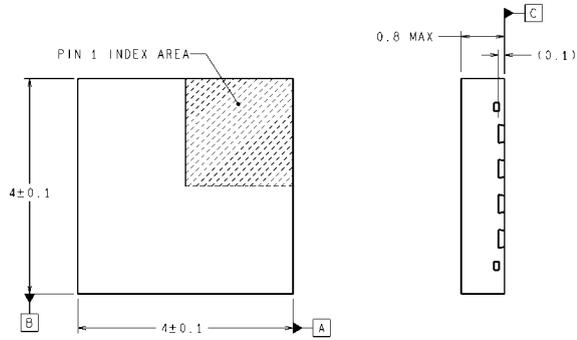
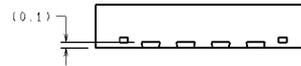
The SDO/ $\overline{\text{SDO}}$ output driver can be enabled or disabled with the ENABLE pin. When set low, the output driver is powered off. ENABLE has an internal pullup.

Physical Dimensions inches (millimeters) unless otherwise noted



RECOMMENDED LAND PATTERN

DIMENSIONS ARE IN MILLIMETERS
DIMENSIONS IN () FOR REFERENCE ONLY



SQB16A (Rev A)

16-Pin LLP
Order Number LMH0302SQ
NS Package Number SQB16A

Notes

For more National Semiconductor product information and proven design tools, visit the following Web sites at:
www.national.com

Products		Design Support	
Amplifiers	www.national.com/amplifiers	WEBENCH® Tools	www.national.com/webench
Audio	www.national.com/audio	App Notes	www.national.com/appnotes
Clock and Timing	www.national.com/timing	Reference Designs	www.national.com/refdesigns
Data Converters	www.national.com/adc	Samples	www.national.com/samples
Interface	www.national.com/interface	Eval Boards	www.national.com/evalboards
LVDS	www.national.com/lvds	Packaging	www.national.com/packaging
Power Management	www.national.com/power	Green Compliance	www.national.com/quality/green
Switching Regulators	www.national.com/switchers	Distributors	www.national.com/contacts
LDOs	www.national.com/ldo	Quality and Reliability	www.national.com/quality
LED Lighting	www.national.com/led	Feedback/Support	www.national.com/feedback
Voltage References	www.national.com/vref	Design Made Easy	www.national.com/easy
PowerWise® Solutions	www.national.com/powerwise	Applications & Markets	www.national.com/solutions
Serial Digital Interface (SDI)	www.national.com/sdi	Mil/Aero	www.national.com/milaero
Temperature Sensors	www.national.com/tempensors	SolarMagic™	www.national.com/solarmagic
PLL/VCO	www.national.com/wireless	PowerWise® Design University	www.national.com/training

THE CONTENTS OF THIS DOCUMENT ARE PROVIDED IN CONNECTION WITH NATIONAL SEMICONDUCTOR CORPORATION ("NATIONAL") PRODUCTS. NATIONAL MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS PUBLICATION AND RESERVES THE RIGHT TO MAKE CHANGES TO SPECIFICATIONS AND PRODUCT DESCRIPTIONS AT ANY TIME WITHOUT NOTICE. NO LICENSE, WHETHER EXPRESS, IMPLIED, ARISING BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT.

TESTING AND OTHER QUALITY CONTROLS ARE USED TO THE EXTENT NATIONAL DEEMS NECESSARY TO SUPPORT NATIONAL'S PRODUCT WARRANTY. EXCEPT WHERE MANDATED BY GOVERNMENT REQUIREMENTS, TESTING OF ALL PARAMETERS OF EACH PRODUCT IS NOT NECESSARILY PERFORMED. NATIONAL ASSUMES NO LIABILITY FOR APPLICATIONS ASSISTANCE OR BUYER PRODUCT DESIGN. BUYERS ARE RESPONSIBLE FOR THEIR PRODUCTS AND APPLICATIONS USING NATIONAL COMPONENTS. PRIOR TO USING OR DISTRIBUTING ANY PRODUCTS THAT INCLUDE NATIONAL COMPONENTS, BUYERS SHOULD PROVIDE ADEQUATE DESIGN, TESTING AND OPERATING SAFEGUARDS.

EXCEPT AS PROVIDED IN NATIONAL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, NATIONAL ASSUMES NO LIABILITY WHATSOEVER, AND NATIONAL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY RELATING TO THE SALE AND/OR USE OF NATIONAL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE CHIEF EXECUTIVE OFFICER AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

National Semiconductor and the National Semiconductor logo are registered trademarks of National Semiconductor Corporation. All other brand or product names may be trademarks or registered trademarks of their respective holders.

Copyright© 2010 National Semiconductor Corporation

For the most current product information visit us at www.national.com



National Semiconductor Americas Technical Support Center
 Email: support@nsc.com
 Tel: 1-800-272-9959

National Semiconductor Europe Technical Support Center
 Email: europe.support@nsc.com

National Semiconductor Asia Pacific Technical Support Center
 Email: ap.support@nsc.com

National Semiconductor Japan Technical Support Center
 Email: jpn.feedback@nsc.com

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Transportation and Automotive	www.ti.com/automotive
Video and Imaging	www.ti.com/video

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2011, Texas Instruments Incorporated