

## 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.

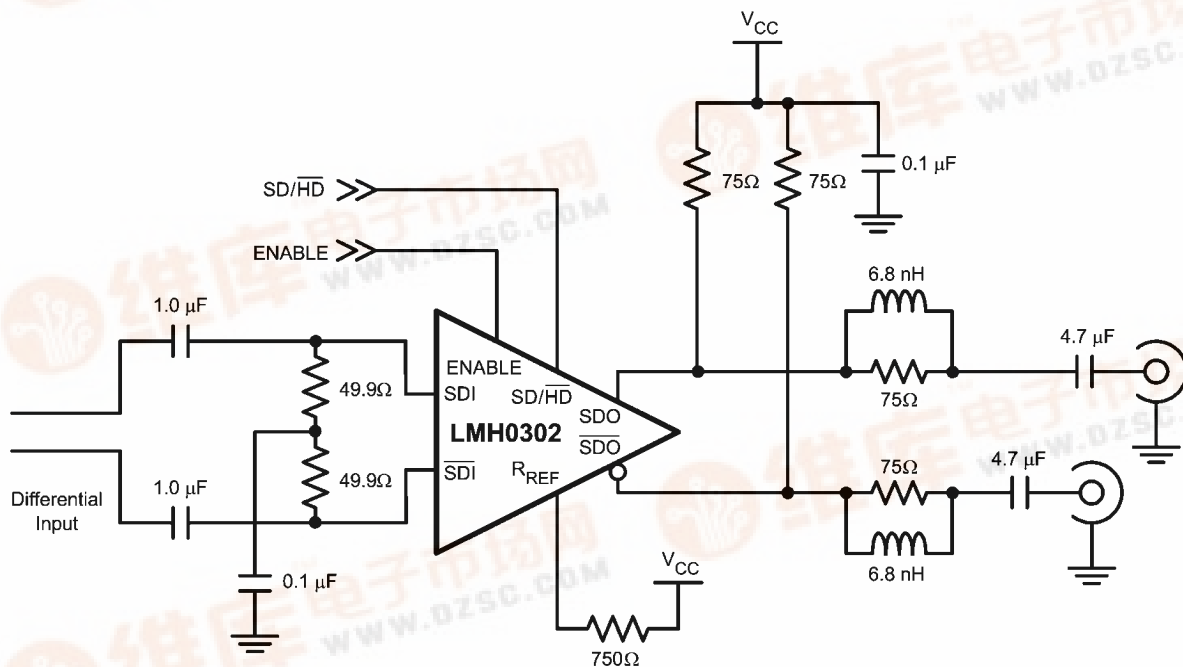
#### Features

- 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



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**Absolute Maximum Ratings** (Note 1)

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Supply Voltage:	-0.5V to 3.6V
Input Voltage (all inputs)	-0.3V to $V_{CC}+0.3V$
Output Current	28mA
Storage Temperature Range	-65°C to +150°C
Junction Temperature	+125°C
Lead Temperature (Soldering 4 Sec)	+260°C
Package Thermal Resistance	
$\theta_{JA}$ 16-pin LLP	+64°C/W
$\theta_{JC}$ 16-pin LLP	+26°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 (Notes 2, 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 <sub>P-P</sub>
$V_{CMOUT}$	Output Common Mode Voltage		SDO, $\overline{SDO}$		$V_{CC} -$ $V_{SDO}$		V
$V_{SDO}$	Output Voltage Swing	Single-ended, 75 $\Omega$ load, $R_{REF} = 750\Omega$ 1%		720	800	880	mV <sub>P-P</sub>
$V_{IH}$	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 <sub>P-P</sub>
		1.485 Gbps			18		ps <sub>P-P</sub>
		270 Mbps			15		ps <sub>P-P</sub>
$t_r, t_f$	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, (Note 4)				27	ps
		SD/ $\overline{HD}$ = 0, 1.485 Gbps, (Note 4)				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, (Note 5)		15			dB
		1.5 GHz - 3.0 GHz, (Note 5)		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.

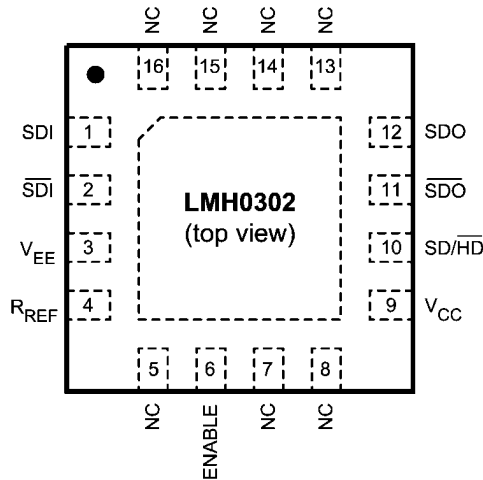
**Note 3:** Typical values are stated for  $V_{CC} = +3.3V$  and  $T_A = +25^\circ C$ .

**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.

## Connection Diagram

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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**  
**See NS Package Number SQB16A**

## 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	$\overline{\text{SD/HD}}$	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).

## Device Operation

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### 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<sub>P-P</sub> into 75Ω AC-coupled coaxial cable with an R<sub>REF</sub> resistor of 750Ω. The R<sub>REF</sub> resistor is connected between the R<sub>REF</sub> pin and V<sub>CC</sub>. The only resistor value that should be used for R<sub>REF</sub> is 750Ω.

The R<sub>REF</sub> resistor should be placed as close as possible to the R<sub>REF</sub> pin. In addition, the copper in the plane layers below

the R<sub>REF</sub> network should be removed to minimize parasitic capacitance.

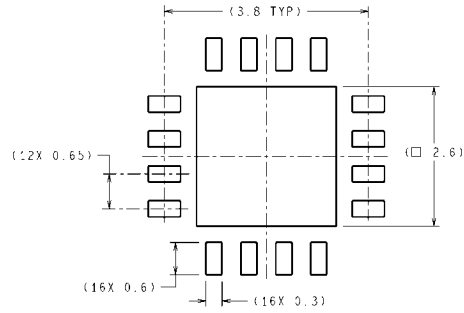
### OUTPUT SLEW RATE CONTROL

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.

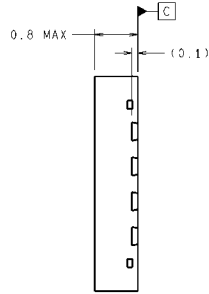
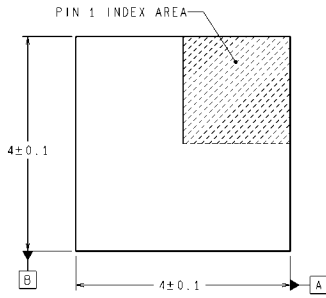
### OUTPUT ENABLE

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.

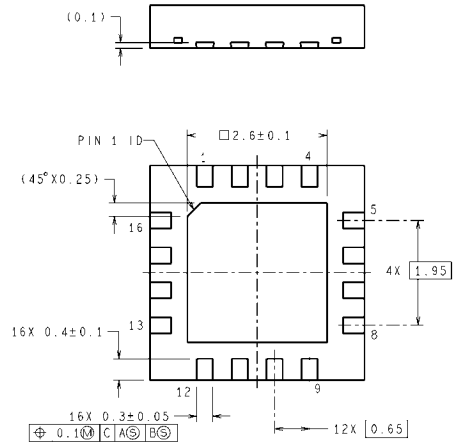
**Physical Dimensions** inches (millimeters) unless otherwise noted  
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**16-Pin LLP**  
**Order Number LMH0302SQ**  
**NS Package Number SQB16A**

SQB16A (Rev A)

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## Notes

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Serial Digital Interface (SDI)	<a href="http://www.national.com/sdi">www.national.com/sdi</a>	Mil/Aero	<a href="http://www.national.com/milaero">www.national.com/milaero</a>
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