3Gbps HD/SD SDI Cable Driver

Check for Samples: LMH0302

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 WQFN 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**

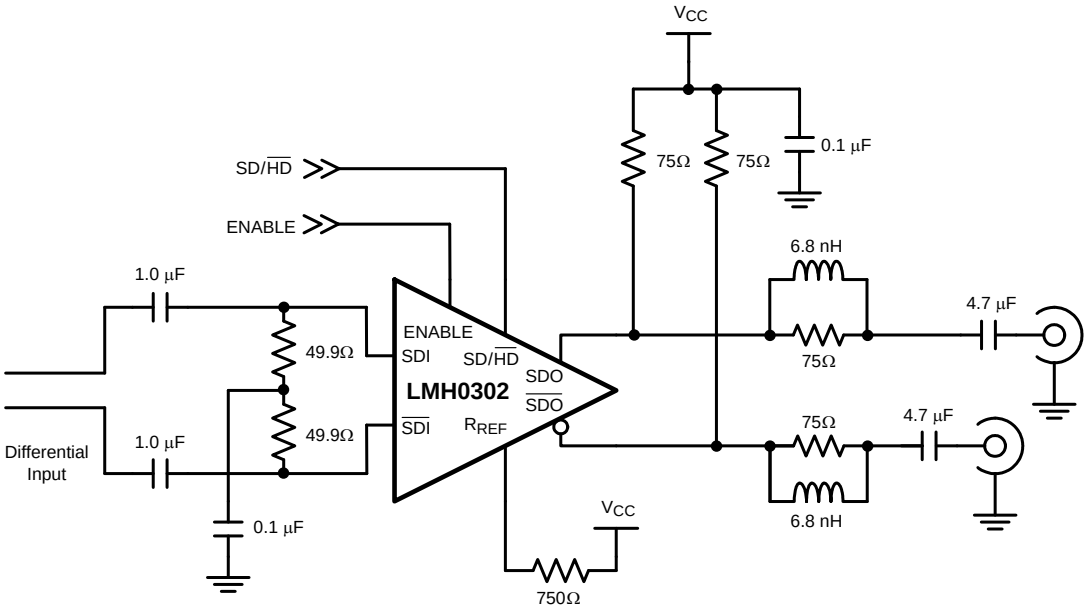
DESCRIPTION

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.

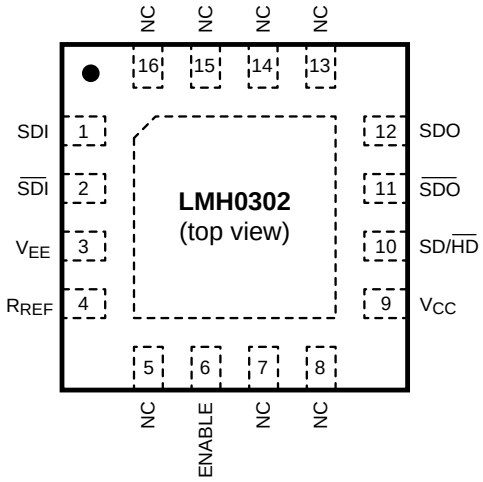
The LMH0302 provides two selectable slew rates for SMPTE 259M and SMPTE 424M / 292M compliance. The output driver may be powered down via the output driver enable pin.

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 WQFN package.

Typical Application



Connection Diagram



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

Figure 1. 16-Pin WQFN
See Package Number RUM

PIN DESCRIPTIONS

Pin	Name	Description
1	SDI	Serial data true input.
2	$\overline{SDI}$	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/$\overline{SDO}$ 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/$\overline{HD}$	Output slew rate control. Output rise/fall time complies with SMPTE 424M / 292M when low and SMPTE 259M when high.
11	$\overline{SDO}$	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).

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings (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 WQFN	+58°C/W
	θ_{JC} 16-pin WQFN	+21°C/W
ESD Rating	HBM	4.5 kV
	MM	250V
	CDM	2 kV

(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.

Recommended Operating Conditions

Supply Voltage (V_{CC} – V_{EE})	3.3V ±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 (1) (2).

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, 75Ω load, R_{REF} = 750Ω 1%		720	800	880	mV_{P-P}
V_{IH}	Input Voltage High Level		SD/$\overline{HD}$, ENABLE	2.0			V
V_{IL}	Input Voltage Low Level					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

(1) 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.
(2) Typical values are stated for V_{CC} = +3.3V and T_A = +25°C.

AC Electrical Characteristics

Over Supply Voltage and Operating Temperature ranges, unless otherwise specified (1).

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, (2)				27	ps
		SD/$\overline{HD}$ = 0, 1.485 Gbps, (2)				30	ps
		SD/$\overline{HD}$ = 1, (2)				100	ps
t_{OS}	Output Overshoot	SD/$\overline{HD}$ = 0, (2)				10	%
		SD/$\overline{HD}$ = 1, (2)				8	%
RL_{SDO}	Output Return Loss	5 MHz - 1.5 GHz, (3)		15			dB
		1.5 GHz - 3.0 GHz, (3)		10			dB

(1) Typical values are stated for V_{CC} = +3.3V and T_A = +25°C.
(2) Specification is guaranteed by characterization.
(3) 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/$\overline{HD}$ pin. For slower rise and fall times, or SMPTE 259M compliance, SD/$\overline{HD}$ is set high. For faster rise and fall times, or SMPTE 424M and SMPTE 292M compliance, SD/$\overline{HD}$ is set low.

OUTPUT ENABLE

The SDO/$\overline{SDO}$ 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.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
LMH0302SQ/NOPB	ACTIVE	WQFN	RUM	16	1000	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	-40 to 85	L0302	Samples
LMH0302SQE/NOPB	ACTIVE	WQFN	RUM	16	250	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	-40 to 85	L0302	Samples
LMH0302SQX/NOPB	ACTIVE	WQFN	RUM	16	4500	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	-40 to 85	L0302	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

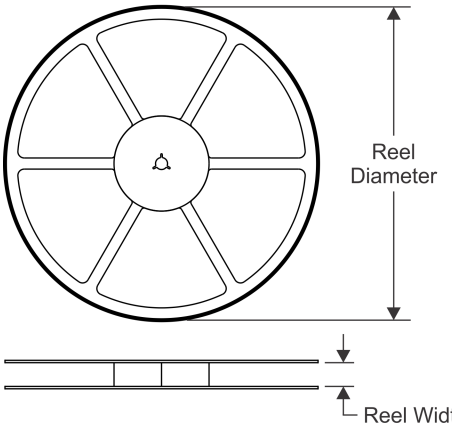
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

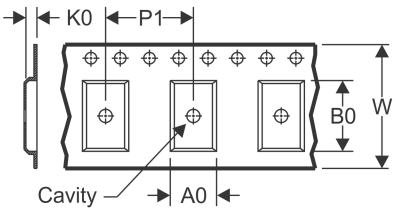
(4) Only one of markings shown within the brackets will appear on the physical device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

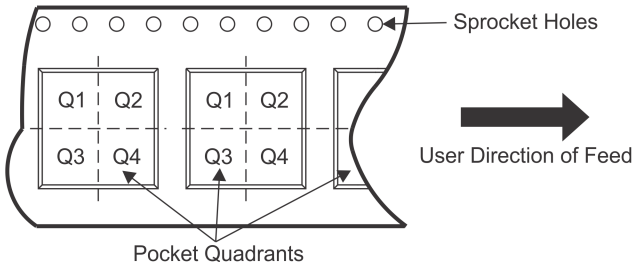


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

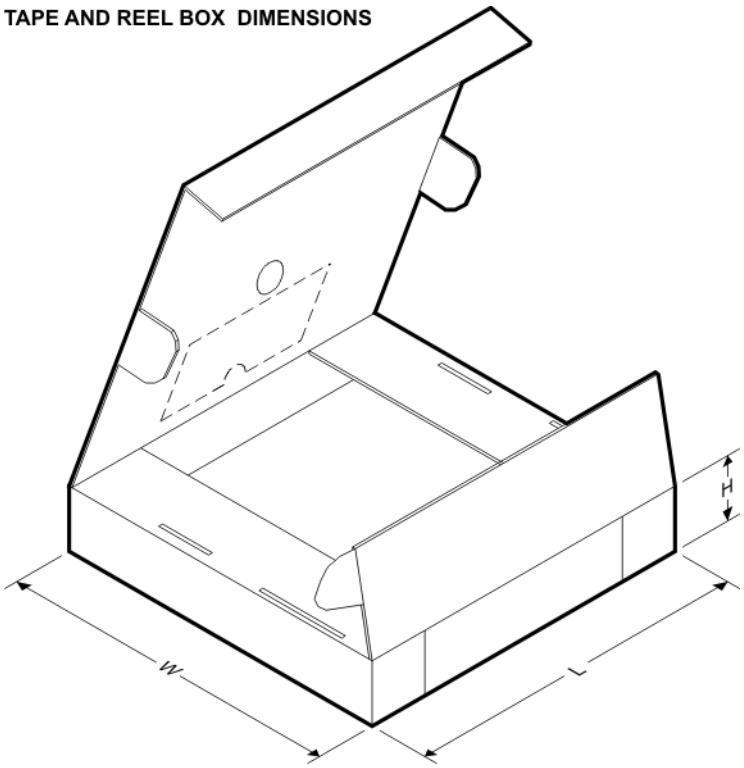
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LMH0302SQ/NOPB	WQFN	RUM	16	1000	178.0	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LMH0302SQE/NOPB	WQFN	RUM	16	250	178.0	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LMH0302SQX/NOPB	WQFN	RUM	16	4500	330.0	12.4	4.3	4.3	1.3	8.0	12.0	Q1

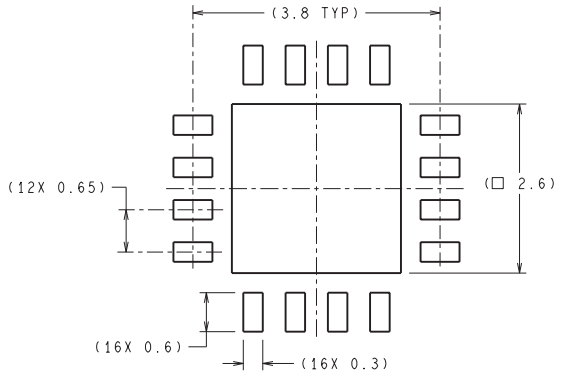
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

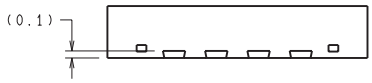
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LMH0302SQ/NOPB	WQFN	RUM	16	1000	213.0	191.0	55.0
LMH0302SQE/NOPB	WQFN	RUM	16	250	213.0	191.0	55.0
LMH0302SQX/NOPB	WQFN	RUM	16	4500	367.0	367.0	35.0

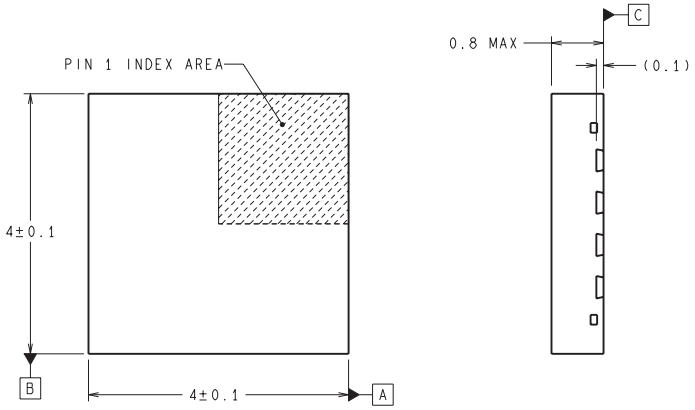
RUM0016A

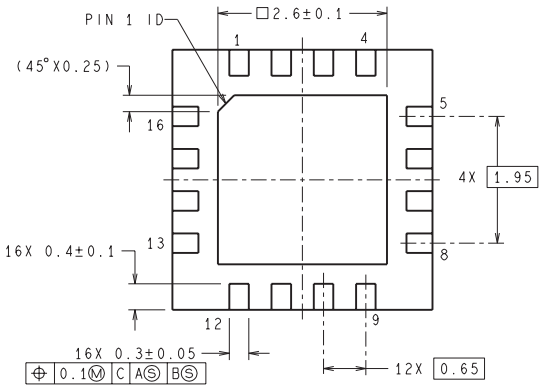


RECOMMENDED LAND PATTERN

DIMENSIONS ARE IN MILLIMETERS
DIMENSIONS IN () FOR REFERENCE ONLY







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