

LMH0001 SMPTE 259M / 344M Serial Digital Cable Driver

Check for Samples: [LMH0001](#)

FEATURES

- **SMPTE 259M and SMPTE 344M Compliant**
- **Data Rates to 540 Mbps**
- **Supports DVB-ASI at 270 Mbps**
- **Differential Input**
- **75Ω Differential Output**
- **Adjustable Output Amplitude**
- **Single 3.3V Supply Operation**
- **Industrial Temperature Range: -40°C to +85°C**
- **125mW Typical Power Consumption**
- **16-pin WQFN Package**
- **Footprint Compatible with the LMH0002SQ and the GS9078A.**

DESCRIPTION

The LMH0001 SMPTE 259M / 344M Serial Digital Cable Driver is designed for use in SMPTE 259M / 344M serial digital video applications. The LMH0001 drives 75Ω transmission lines (Belden 8281, Belden 1694A or equivalent) at data rates up to 540 Mbps.

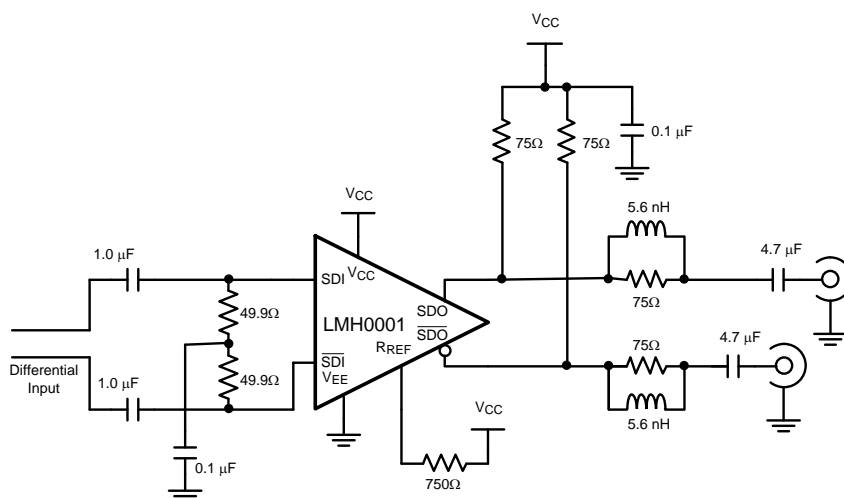
The output voltage swing of the LMH0001 is adjustable via a single external resistor.

The LMH0001 is powered from a single 3.3V supply. Power consumption is typically 125mW. The LMH0001 is available in a 16-pin WQFN package.

APPLICATIONS

- **SMPTE 259M and SMPTE 344M Serial Digital Interfaces**
- **DVB-ASI Applications**
- **Sonet/SDH and ATM Interfaces**
- **Digital Routers and Switches**
- **Distribution Amplifiers**
- **Buffer Applications**
- **Set Top Boxes**
- **Security Cameras**

Typical Application



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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 | 28mA |
| Storage Temperature Range | -65°C to +150°C |
| Junction Temperature | +150°C |
| Lead Temperature (Soldering 4 Sec) | +260°C |
| Package Thermal Resistance θ_{JA} 16-pin WQFN θ_{JC} 16-pin WQFN | +78.9°C/W +42.7°C/W |
| ESD Rating (HBM) | 5kV |
| ESD Rating (MM) | 250V |

- (1) Absolute Maximum Ratings are those parameter values beyond which the life and operation of the device cannot be ensured. 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 $\pm 5\%$ |
| Operating Free Air Temperature (T_A) | -40°C to +85°C |

DC Electrical Characteristics

Over Supply Voltage and Operating Temperature ranges, unless otherwise specified ⁽¹⁾⁽²⁾.

| Parameter | | Test Conditions | Reference | Min | Typ | Max | Unit |
|-------------|----------------------------|---|-----------------------|----------------------|-------------------------|---------------------------|-------------------|
| V_{CMIN} | Input Common Mode Voltage | | SDI, \overline{SDI} | 1.6 + $V_{SDI}/2$ | | $V_{CC} -$ $V_{SDI}/2$ | V |
| V_{SDI} | Input Voltage Swing | Differential | | 100 | | 2000 | 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, $R_{REF} = 750\Omega$ 1% | | 750 | 800 | 850 | mV _{P-P} |
| | | Single-ended, 75Ω load, $R_{REF} = 590\Omega$ 1% | | 900 | 1000 | 1100 | mV _{P-P} |
| I_{CC} | Supply Current | | | | ⁽³⁾ 38 | 43 | 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 $T_A = +25^\circ C$.
(3) Maximum I_{CC} is measured at $V_{CC} = +3.465V$ and $T_A = +70^\circ C$.

AC Electrical Characteristics

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

| Parameter | Test Conditions | Reference | Min | Typ | Max | Unit |
|---------------------------------|-----------------------------|---|-------------------|-----|-----|-------|
| DR _{SDI} | Input Data Rate | ⁽²⁾ SDI, $\overline{\text{SDI}}$ | | | 540 | Mbps |
| t _{jit} | Additive Jitter | 270 Mbps | | 18 | | pSp.p |
| t _r , t _f | Output Rise Time, Fall Time | 20% – 80% | 400 | 560 | 800 | ps |
| | Mismatch in Rise/Fall Time | ⁽²⁾ | | | 30 | ps |
| | Duty Cycle Distortion | ⁽²⁾ | | | 100 | ps |
| t _{OS} | Output Overshoot | ⁽²⁾ | | | 8 | % |
| RL _{SDO} | Output Return Loss | | ⁽³⁾ 15 | 20 | | dB |

- (1) Typical values are stated for V_{CC} = +3.3V and T_A = +25°C.
- (2) Specification is ensured by characterization.
- (3) Output return loss is dependent on board design. The LMH0001 meets this specification on the SD001SQ evaluation board from 5MHz to 1.5GHz.

CONNECTION DIAGRAM

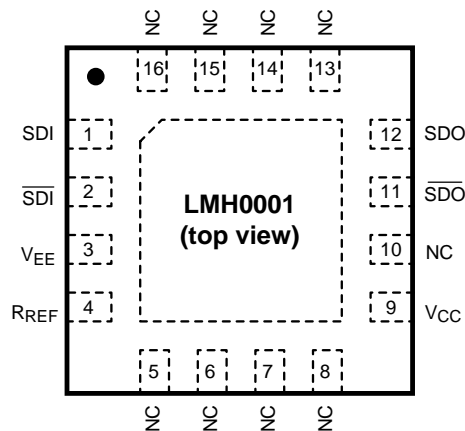


Figure 1. 16-Pin WQFN Package
See Package Number RUM0016A

PIN DESCRIPTIONS

| SOIC Pin No. | WQFN Pin No. | Name | Description |
|--------------|--------------------------------|-------------------------|---|
| 1 | 1 | SDI | Serial data true input. |
| 2 | 2 | $\overline{\text{SDI}}$ | Serial data complement input. |
| 3 | 3 | V _{EE} | Negative power supply (ground). |
| 4 | 4 | R _{REF} | Output driver level control. Connect a resistor to V _{CC} to set output voltage swing. |
| 5 | 9 | V _{CC} | Positive power supply (+3.3V). |
| 7 | 11 | $\overline{\text{SDO}}$ | Serial data complement output. |
| 8 | 12 | SDO | Serial data true output. |
| — | 5, 6, 7, 8, 10, 13, 14, 15, 16 | NC | No connect. |
| — | DAP | V _{EE} | Connect exposed DAP to negative power supply (ground). |

DEVICE OPERATION

INPUT INTERFACING

The LMH0001 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. $\overline{\text{SDI}}$ and $\overline{\text{SDI}}$ are self-biased at approximately 2.1V with $V_{CC} = 3.3\text{V}$. Figure 2 shows the differential input stage for $\overline{\text{SDI}}$ and $\overline{\text{SDI}}$.

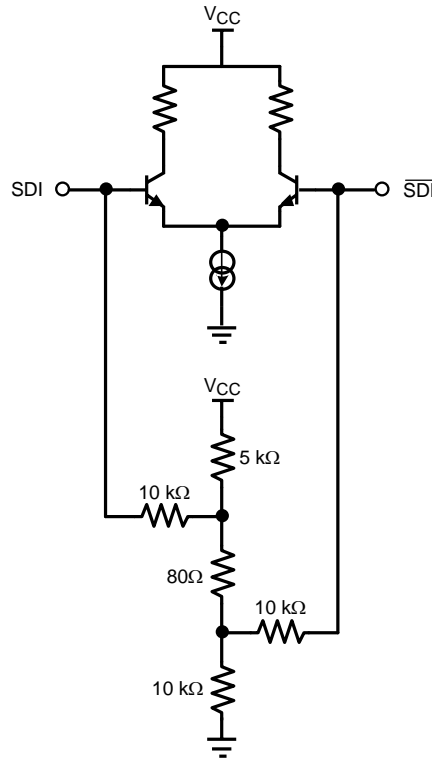


Figure 2. Differential Input Stage for $\overline{\text{SDI}}$ and $\overline{\text{SDI}}$.

OUTPUT INTERFACING

The LMH0001 uses current mode outputs. Single-ended output levels are 800 mV_{P-P} into 75Ω AC-coupled coaxial cable (with $R_{REF} = 750\Omega$). Output level is controlled by the value of the R_{REF} resistor connected between the R_{REF} pin and V_{CC} .

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.

REVISION HISTORY

| Changes from Revision B (April 2013) to Revision C | Page |
|--|-------------------|
| • Changed layout of National Data Sheet to TI format | 4 |

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 |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|------------------|----------------------|--------------|--------------------------|-------------------------|
| LMH0001SQ/NOPB | ACTIVE | WQFN | RUM | 16 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 85 | L001 | Samples |
| LMH0001SQE/NOPB | ACTIVE | WQFN | RUM | 16 | 250 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 85 | L001 | Samples |
| LMH0001SQX/NOPB | ACTIVE | WQFN | RUM | 16 | 4500 | Green (RoHS & no Sb/Br) | CU SN | Level-1-260C-UNLIM | -40 to 85 | L001 | 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) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

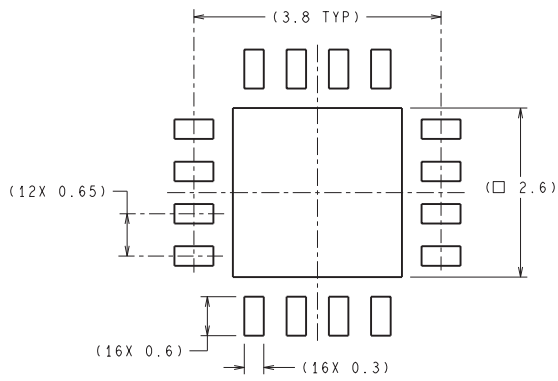
| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LMH0001SQ/NOPB | WQFN | RUM | 16 | 1000 | 178.0 | 12.4 | 4.3 | 4.3 | 1.3 | 8.0 | 12.0 | Q1 |
| LMH0001SQE/NOPB | WQFN | RUM | 16 | 250 | 178.0 | 12.4 | 4.3 | 4.3 | 1.3 | 8.0 | 12.0 | Q1 |
| LMH0001SQX/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

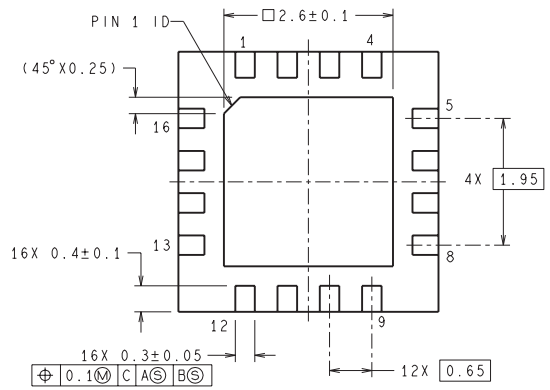
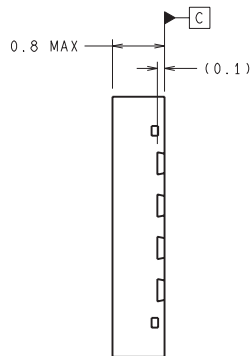
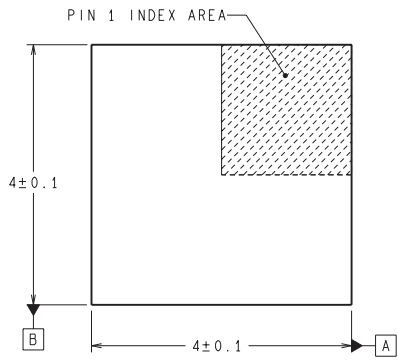
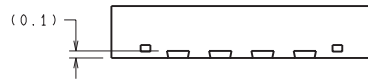
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LMH0001SQ/NOPB | WQFN | RUM | 16 | 1000 | 210.0 | 185.0 | 35.0 |
| LMH0001SQE/NOPB | WQFN | RUM | 16 | 250 | 210.0 | 185.0 | 35.0 |
| LMH0001SQX/NOPB | WQFN | RUM | 16 | 4500 | 367.0 | 367.0 | 35.0 |

RUM0016A



RECOMMENDED LAND PATTERN

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SQB16A (Rev A)

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