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.**

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**

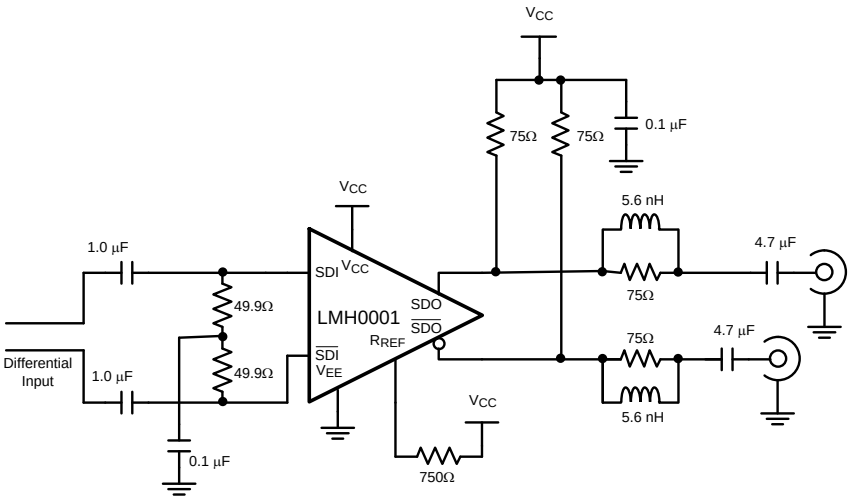
DESCRIPTION

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.

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 ±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} = 750Ω 1%		750	800	850	mV_{P-P}
		Single-ended, 75Ω load, R_{REF} = 590Ω 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°C.
(3) Maximum I_{CC} is measured at V_{CC} = +3.465V and T_A = +70°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, $\overline{SDI}$			540	Mbps
t_{jit}	Additive Jitter	270 Mbps	SDO, $\overline{SDO}$		18		ps_{P-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

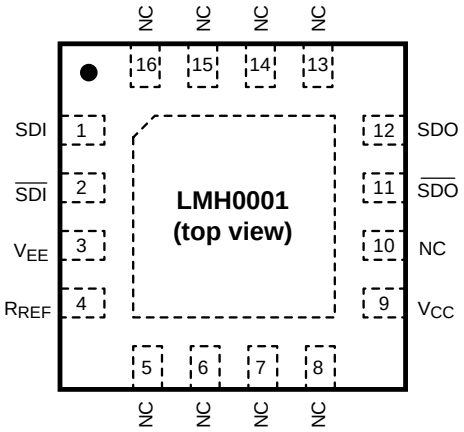


Figure 1. 16-Pin WQFN Package
See Package Number RUM0016A

PIN DESCRIPTIONS

SOIC Pin No.	WQFN Pin No.	Name	Description
1	1	SDI	Serial data true input.
2	2	$\overline{SDI}$	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	$\overline{SDO}$	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. SDI and $\overline{SDI}$ are self-biased at approximately 2.1V with V_{CC} = 3.3V. Figure 2 shows the differential input stage for SDI and $\overline{SDI}$.

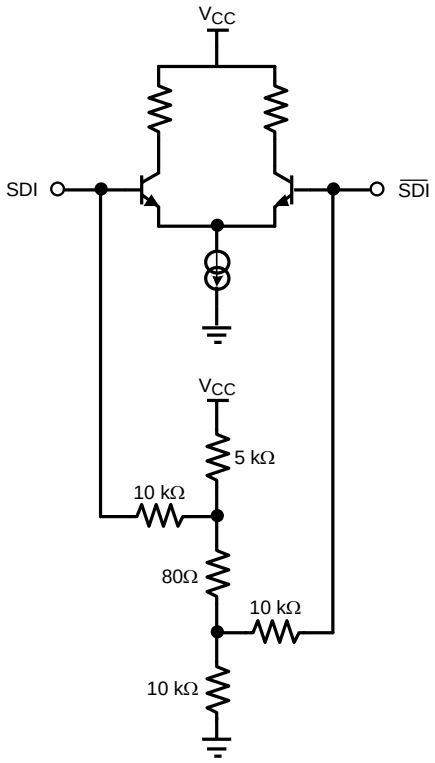


Figure 2. Differential Input Stage for SDI and $\overline{SDI}$.

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} = 750Ω). 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 part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LMH0001SQ/NOPB	Active	Production	WQFN (RUM) | 16	1000 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	L001
LMH0001SQ/NOPB.A	Active	Production	WQFN (RUM) | 16	1000 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	L001
LMH0001SQE/NOPB	Active	Production	WQFN (RUM) | 16	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	L001
LMH0001SQE/NOPB.A	Active	Production	WQFN (RUM) | 16	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	L001

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

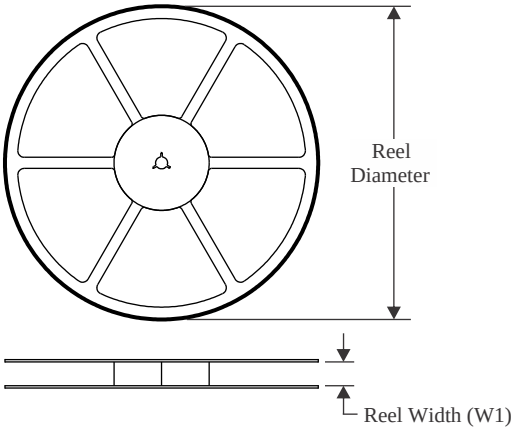
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

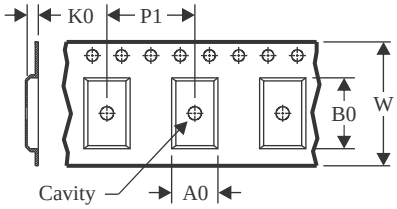
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

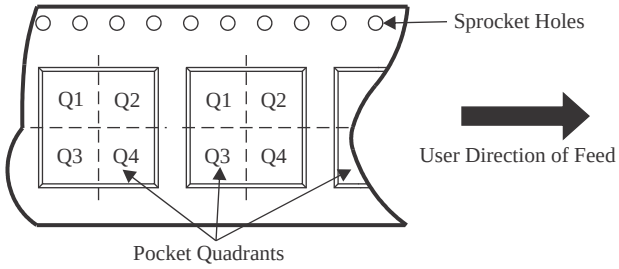


TAPE DIMENSIONS



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

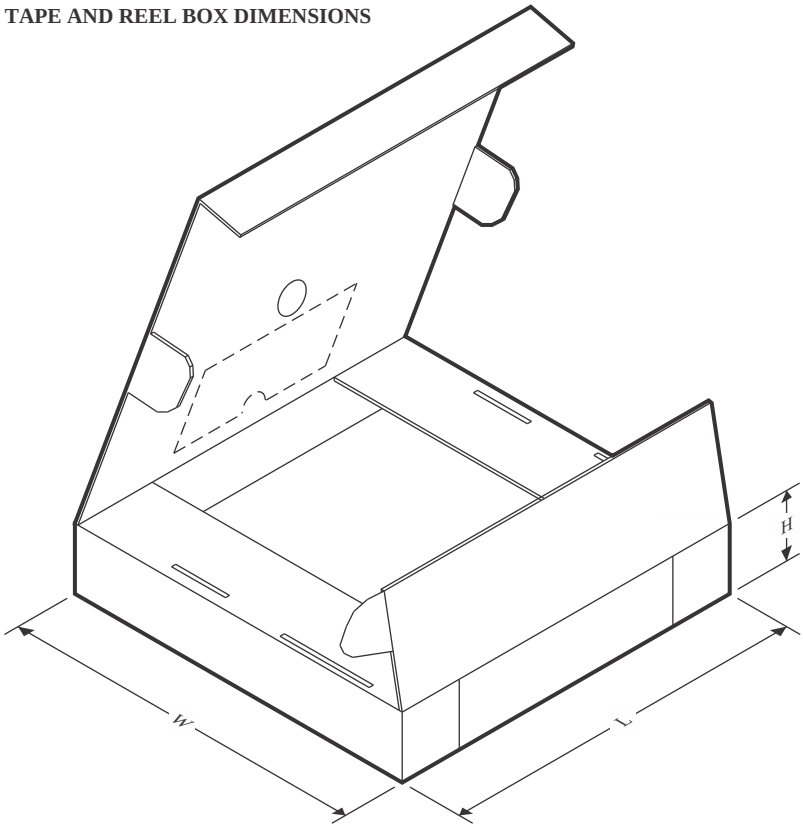
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
LMH0001SQ/NOPB	WQFN	RUM	16	1000	177.8	12.4	4.3	4.3	1.3	8.0	12.0	Q1
LMH0001SQE/NOPB	WQFN	RUM	16	250	177.8	12.4	4.3	4.3	1.3	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

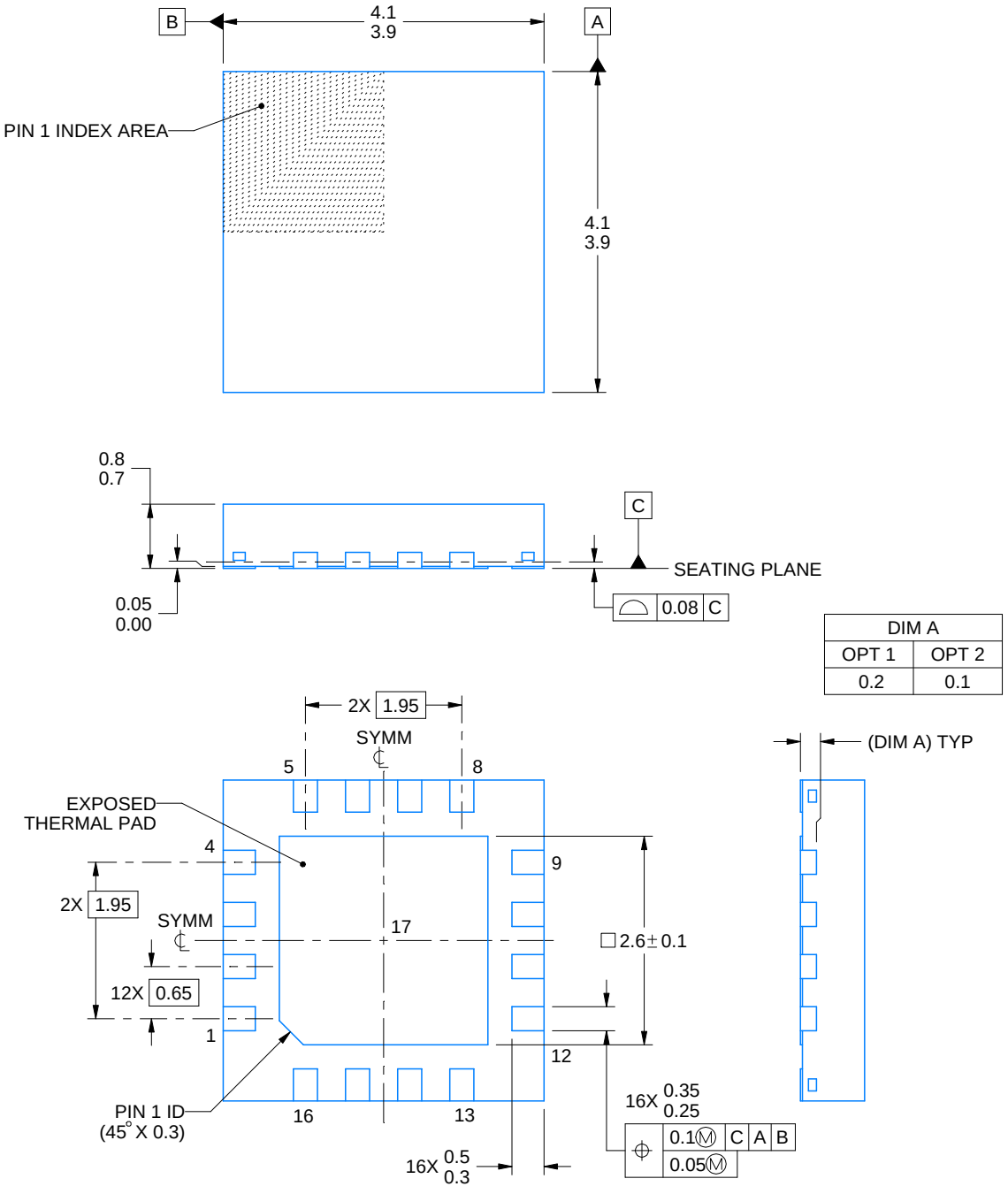
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LMH0001SQ/NOPB	WQFN	RUM	16	1000	208.0	191.0	35.0
LMH0001SQE/NOPB	WQFN	RUM	16	250	208.0	191.0	35.0

RUM0016A

PACKAGE OUTLINE

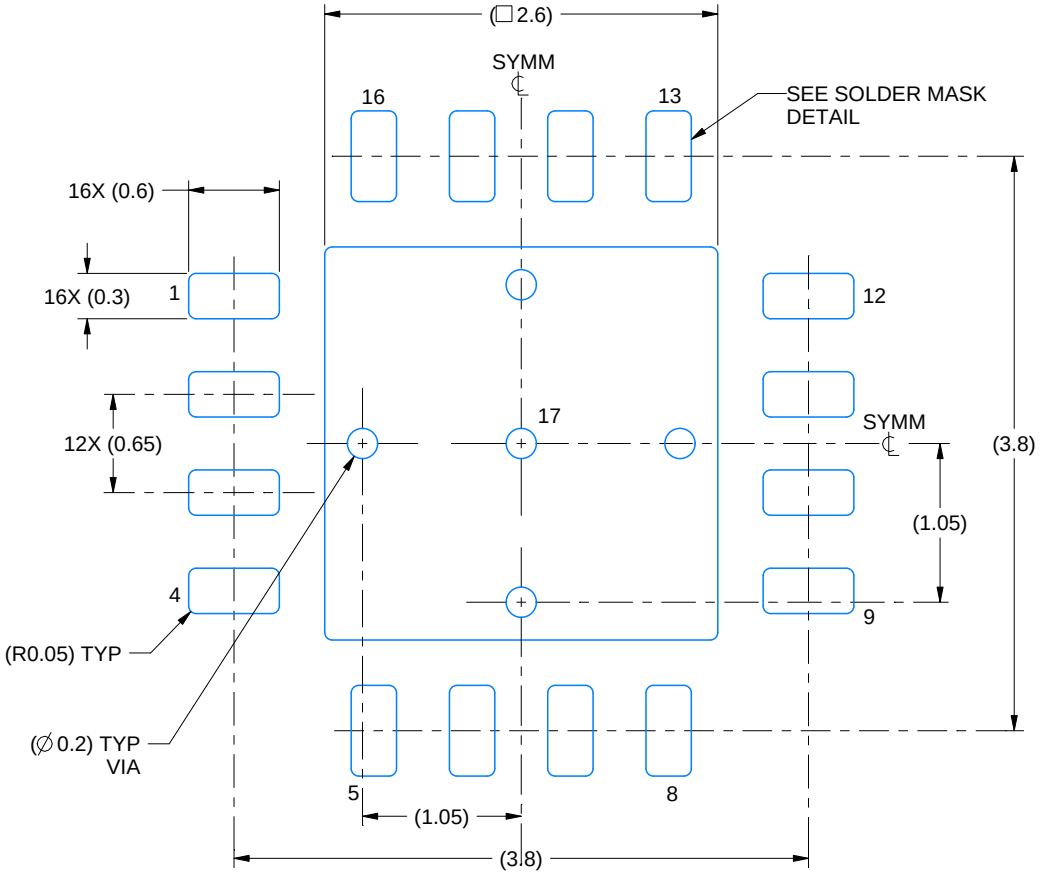
WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

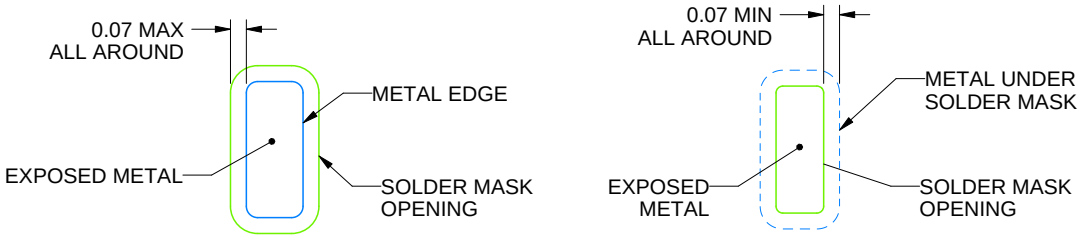


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



NON SOLDER MASK DEFINED (PREFERRED)

SOLDER MASK DEFINED

SOLDER MASK DETAILS

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NOTES: (continued)

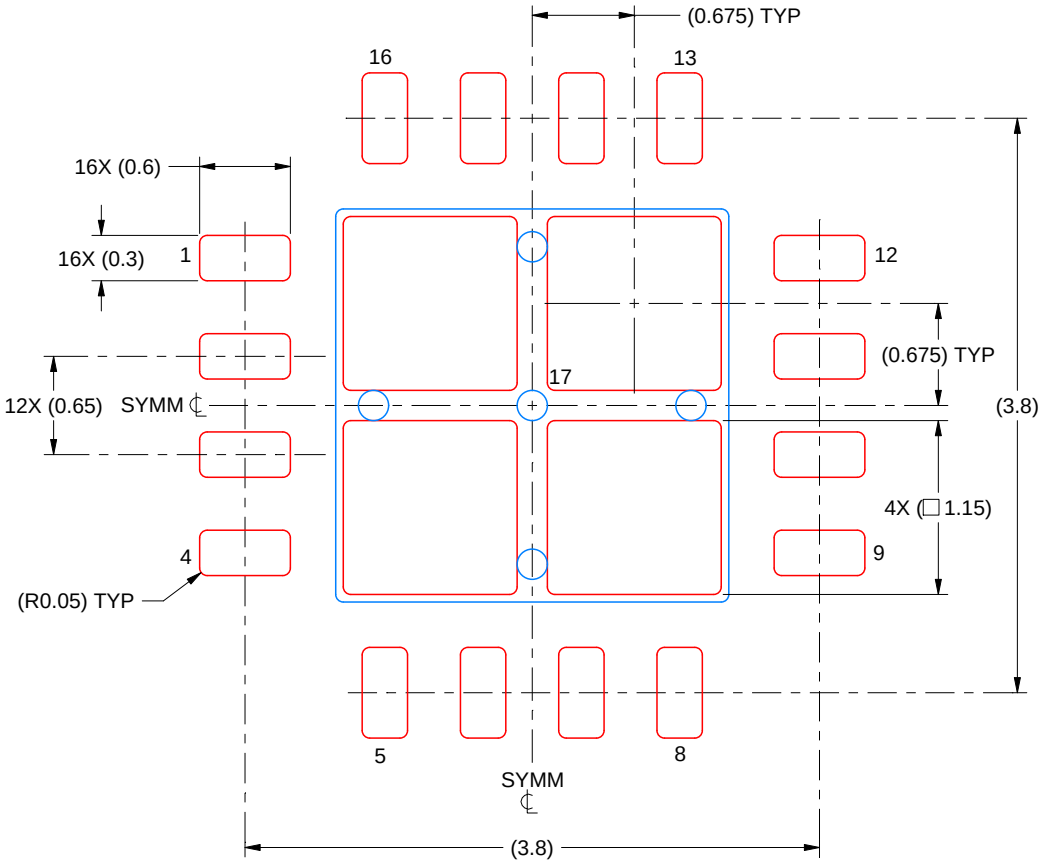
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.

EXAMPLE STENCIL DESIGN

RUM0016A

WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.125 MM THICK STENCIL
SCALE: 20X

EXPOSED PAD 17
78% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE

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NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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