DS30BA101 3.125 Gbps Differential Buffer

Check for Samples: DS30BA101

FEATURES

- **Data Rates from DC to 3.125 Gbps**
- **Supports SD and HD Video Resolutions**
- **Power Consumption: 165 mW Typical**
- **Industrial Temperature Range: -40°C to +85°C**

APPLICATIONS

- **Cable Extension**
- **Signal Buffering and Repeating**
- **Security and Surveillance**

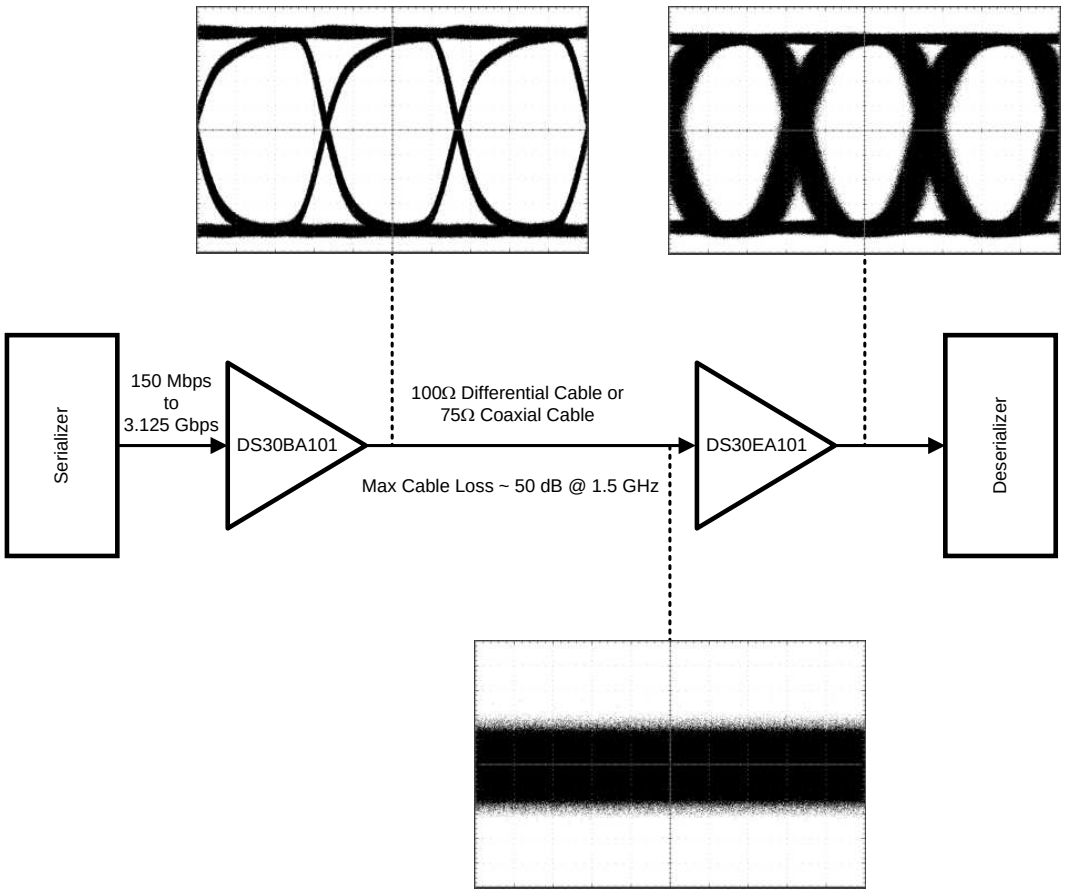
DESCRIPTION

The DS30BA101 is a high-speed differential buffer for cable driving, signal buffering, and signal repeating applications. Its fully differential signal path ensures exceptional signal integrity and noise immunity. The DS30BA101 drives both differential and single-ended transmission lines at data rates up to 3.125 Gbps.

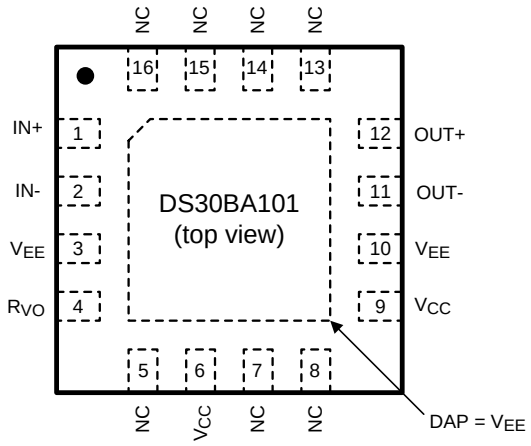
The output voltage amplitude is adjustable via a single external resistor for cable driving applications into 75Ω single-ended and 100Ω differential mode impedances.

The DS30BA101 is powered from a single 3.3V supply and consumes 165 mW (typical). It operates over the full industrial temperature range of -40°C to +85°C and is available in a 4 x 4 mm 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 Package
See Package Number RUM0016A

PIN DESCRIPTIONS

Pin	Name	I/O, Type	Description
1	IN+	I, CML	Non-inverting input.
2	IN-	I, CML	Inverting input.
3	V_{EE}	Ground	Negative power supply (ground).
4	R_{VO}	I, Analog	Output voltage level control. Connect a resistor between this pin and V_{CC} to set the output voltage.
5	NC	N/A	No connect. Not bonded internally.
6	V_{CC}	Power	Positive power supply (+3.3V).
7	NC	N/A	No connect. Not bonded internally.
8	NC	N/A	No connect. Not bonded internally.
9	V_{CC}	Power	Positive power supply (+3.3V).
10	V_{EE}	Ground	Negative power supply (ground).
11	OUT-	O, Data	Inverting output.
12	OUT+	O, Data	Non-inverting output.
13	NC	N/A	No connect. Not bonded internally.
14	NC	N/A	No connect. Not bonded internally.
15	NC	N/A	No connect. Not bonded internally.
16	NC	N/A	No connect. Not bonded internally.
DAP	V_{EE}	Ground	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:	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
Package Thermal Resistance θ_{JA} 16-pin WQFN θ_{JC} 16-pin WQFN	 +58°C/W +21°C/W
ESD Rating (HBM)	≥±4.5 kV
ESD Rating (MM)	≥±250V
ESD Rating (CDM)	≥±2 kV

(1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device my occur, including inoperability and degradation of device reliability and/or performance. Functional operation of the device and/or non-degradation at the Absolute Maximum Ratings or other conditions beyond those indicated in the Recommended Operating Conditions is not implied. The Recommended Operating Conditions indicate conditions at which the device is functional and the device should not be operated beyond such conditions.

Recommended Operating Conditions

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

DC Electrical Characteristics

Over recommended supply voltage and operating temperature ranges, unless otherwise specified. (1) (2)

Parameter		Test Conditions	Reference	Min	Typ	Max	Units
V_{ICM}	Input Common Mode Voltage		IN+, IN-	1.1 + V_{ID}/2		V_{CC} – V_{ID}/2	V
V_{ID}	Input Voltage Swing	Differential		100		2200	mV_{P-P}
V_{OCM}	Output Common Mode Voltage		OUT+, OUT-		V_{CC} – V_{OUT}		V
V_{OUT}	Output Voltage	Single-ended, 75Ω load, R_{VO} = 750Ω			800		mV_{P-P}
		Single-ended, 50Ω load, R_{VO} = 953Ω			400		mV_{P-P}
I_{CC}	Supply Current				50	59	mA

(1) The Electrical Characteristics tables list ensured specifications under the listed Recommended Operating Conditions except as otherwise modified or specified by the Electrical Characteristics Conditions and/or Notes. Typical specifications are estimations only and are not ensured.
(2) Typical values represent most likely parametric norms at V_{CC} = +3.3V, T_A = +25°C, and at the Recommended Operating Conditions at the time of product characterization and are not ensured.

AC Electrical Characteristics

Over recommended supply voltage and operating temperature ranges, unless otherwise specified. (1) (2)

Parameter		Test Conditions	Reference	Min	Typ	Max	Units
DR_{IN}	Input Data Rate		IN+, IN-			3125	Mbps
t_{TLH}	Transition Time Low to High	20% - 80% (3)	OUT+, OUT-		90	130	ps
t_{THL}	Transition Time High to Low				90	130	ps

(1) The Electrical Characteristics tables list ensured specifications under the listed Recommended Operating Conditions except as otherwise modified or specified by the Electrical Characteristics Conditions and/or Notes. Typical specifications are estimations only and are not ensured.
(2) Typical values represent most likely parametric norms at V_{CC} = +3.3V, T_A = +25°C, and at the Recommended Operating Conditions at the time of product characterization and are not ensured.
(3) Specification is ensured by characterization and is not tested in production.

DEVICE OPERATION

INPUT INTERFACING

The DS30BA101 accepts either differential or single-ended input. DC-coupled inputs must be kept within the specified common-mode range.

OUTPUT INTERFACING

The DS30BA101 uses current mode outputs. Single-ended output levels are 800 mV_{P-P} into 75Ω AC-coupled coaxial cable with an R_{VO} resistor of 750Ω, or 400 mV_{P-P} (800 mV_{P-P} differential) into 100Ω differential cable with an R_{VO} resistor of 953Ω. The output voltage level is controlled by the value of the R_{VO} resistor connected between the R_{VO} pin and V_{CC}.

The R_{VO} resistor should be placed as close as possible to the R_{VO} pin. In addition, the copper in the plane layers below the R_{VO} network should be removed to minimize parasitic capacitance.

Figure 2 and Figure 3 show the typical configurations for differential output and single-ended output, respectively. For single-ended output, the unused output must be properly terminated as shown.

APPLICATION INFORMATION

CABLE EXTENDER APPLICATION

The DS30BA101 together with the DS30EA101 form a cable extender chipset optimized for extending serial data streams from serializer/deserializer (SerDes) pairs and FPGAs over 100Ω differential cables and 75Ω coaxial cables. Setting the correct DS30BA101 output amplitude and proper cable termination are essential for optimal operation. Figure 2 shows the recommended chipset configuration for 100Ω differential cable and Figure 3 shows the recommended chipset configuration for 75Ω coaxial cable.

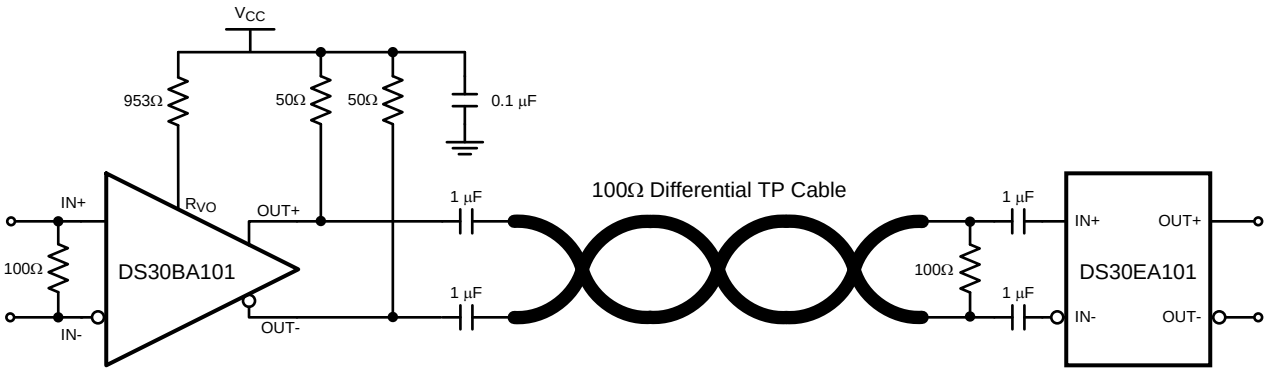


Figure 2. Cable Extender Chipset Application Circuit for 100Ω Differential Cable

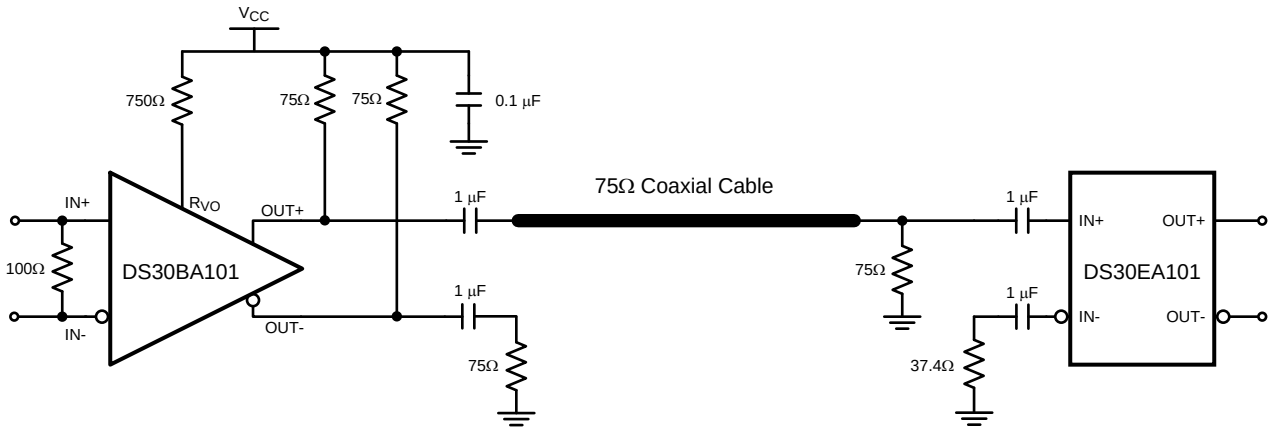


Figure 3. Cable Extender Chipset Application Circuit for 75Ω Coaxial Cable

REVISION HISTORY

Changes from Original (April 2013) to Revision A	Page
• Changed layout of National Data Sheet to TI format	5

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)
DS30BA101SQ/NOPB	Active	Production	WQFN (RUM) | 16	1000 | SMALL T&R	Yes	SN	Level-3-260C-168 HR	-40 to 85	30BA101
DS30BA101SQ/NOPB.A	Active	Production	WQFN (RUM) | 16	1000 | SMALL T&R	Yes	SN	Level-3-260C-168 HR	-40 to 85	30BA101
DS30BA101SQE/NOPB	Active	Production	WQFN (RUM) | 16	250 | SMALL T&R	Yes	SN	Level-3-260C-168 HR	-40 to 85	30BA101
DS30BA101SQE/NOPB.A	Active	Production	WQFN (RUM) | 16	250 | SMALL T&R	Yes	SN	Level-3-260C-168 HR	-40 to 85	30BA101
DS30BA101SQE/NOPB.B	Active	Production	WQFN (RUM) | 16	250 | SMALL T&R	-	Call TI	Call TI	-40 to 85	
DS30BA101SQX/NOPB	Active	Production	WQFN (RUM) | 16	4500 | LARGE T&R	Yes	SN	Level-3-260C-168 HR	-40 to 85	30BA101
DS30BA101SQX/NOPB.A	Active	Production	WQFN (RUM) | 16	4500 | LARGE T&R	Yes	SN	Level-3-260C-168 HR	-40 to 85	30BA101
DS30BA101SQX/NOPB.B	Active	Production	WQFN (RUM) | 16	4500 | LARGE T&R	-	Call TI	Call TI	-40 to 85	

(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.

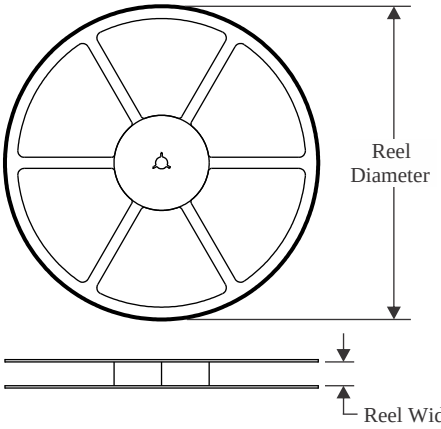
(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

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.

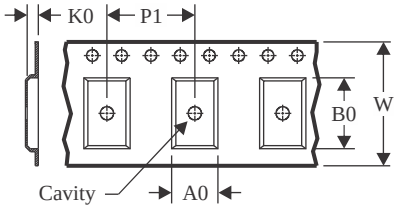
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

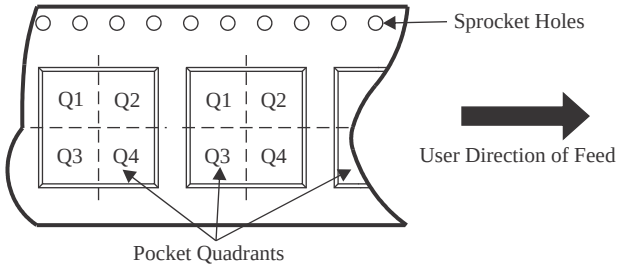


TAPE DIMENSIONS



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

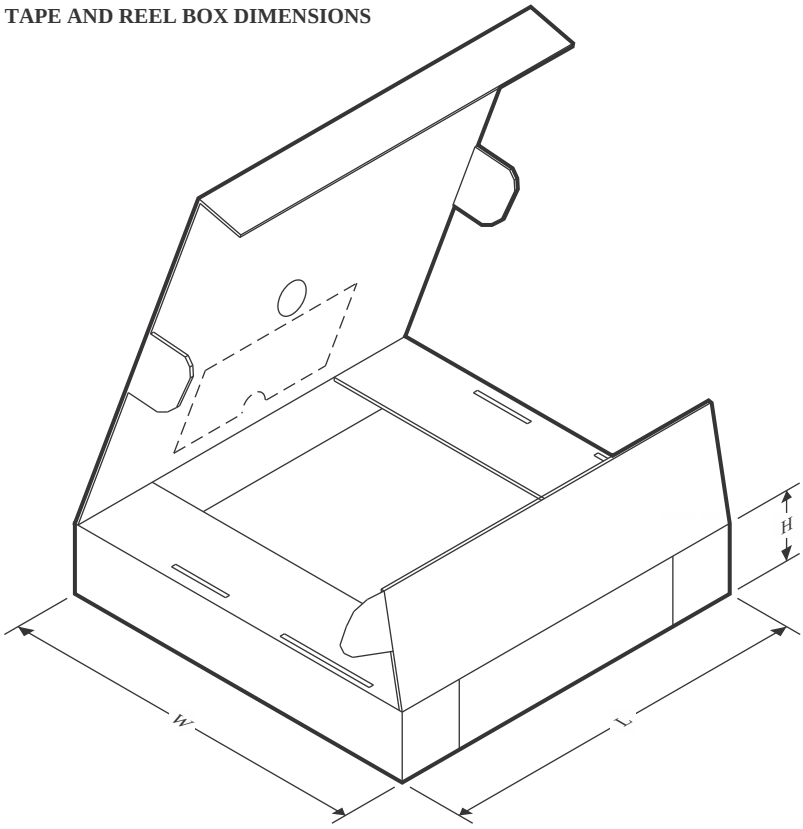
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
DS30BA101SQ/NOPB	WQFN	RUM	16	1000	177.8	12.4	4.3	4.3	1.3	8.0	12.0	Q1
DS30BA101SQE/NOPB	WQFN	RUM	16	250	177.8	12.4	4.3	4.3	1.3	8.0	12.0	Q1
DS30BA101SQX/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

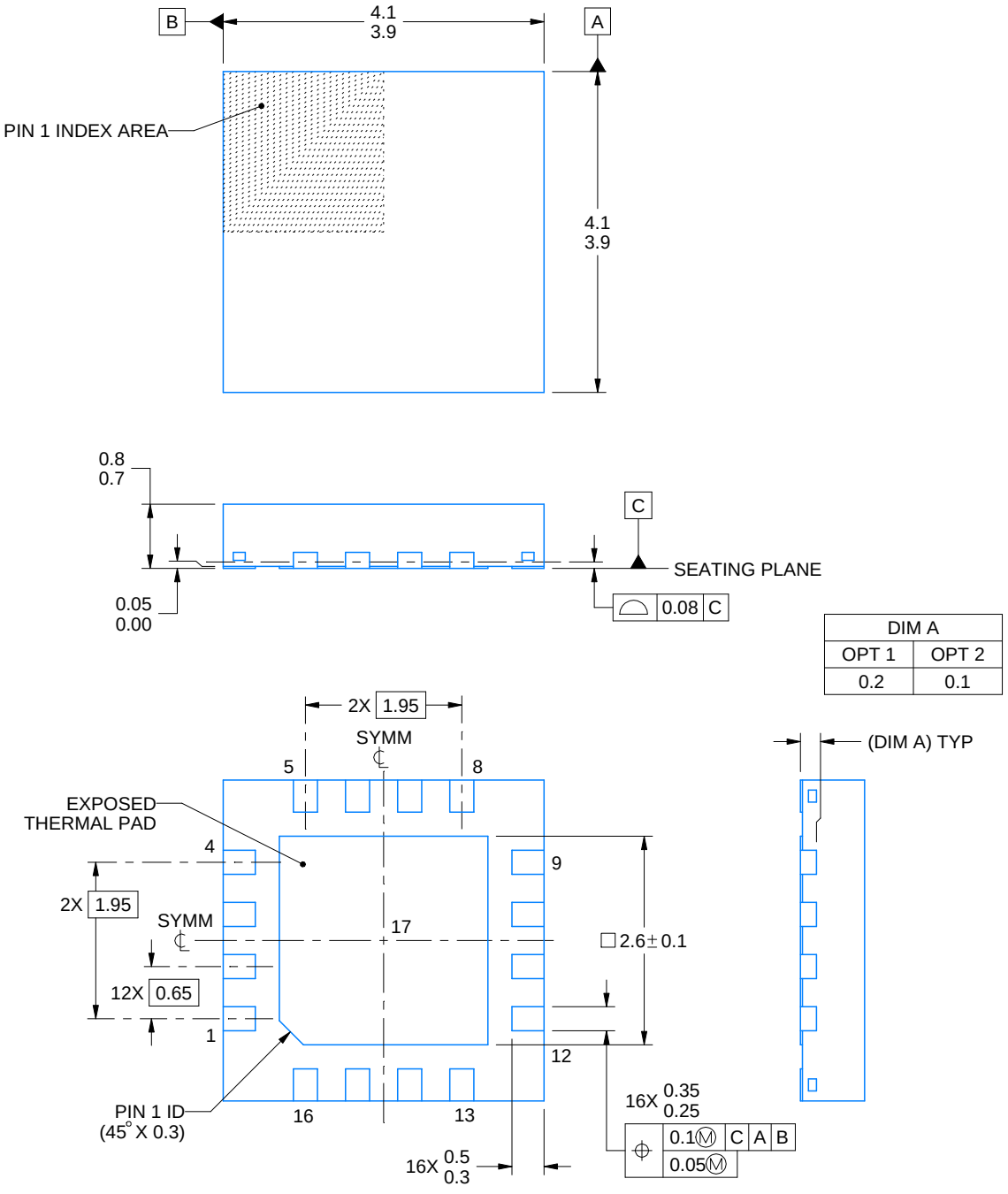
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DS30BA101SQ/NOPB	WQFN	RUM	16	1000	208.0	191.0	35.0
DS30BA101SQE/NOPB	WQFN	RUM	16	250	208.0	191.0	35.0
DS30BA101SQX/NOPB	WQFN	RUM	16	4500	356.0	356.0	36.0

RUM0016A

PACKAGE OUTLINE

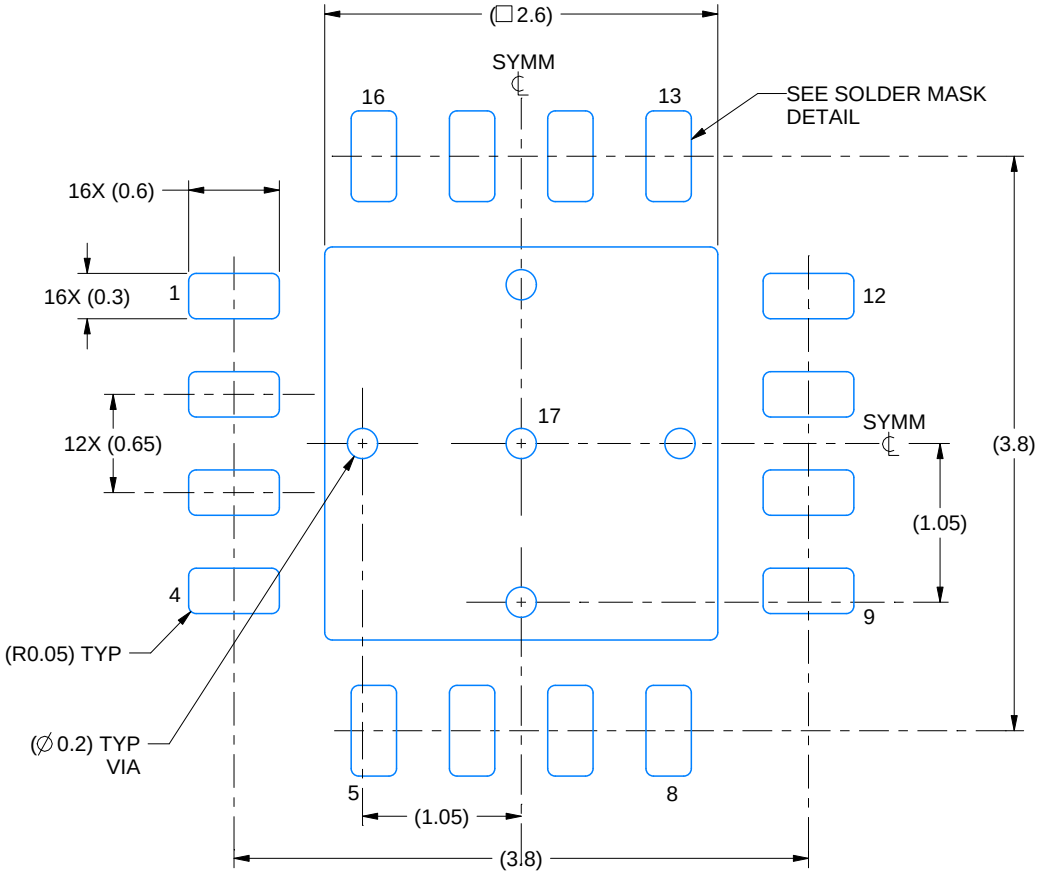
WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

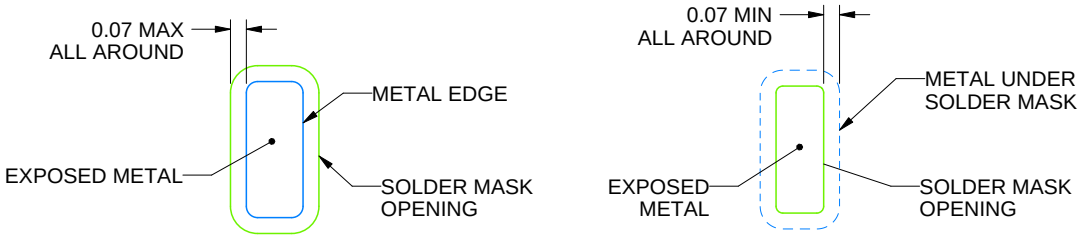


NOTES:

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

4214998/A 11/2021

NOTES: (continued)

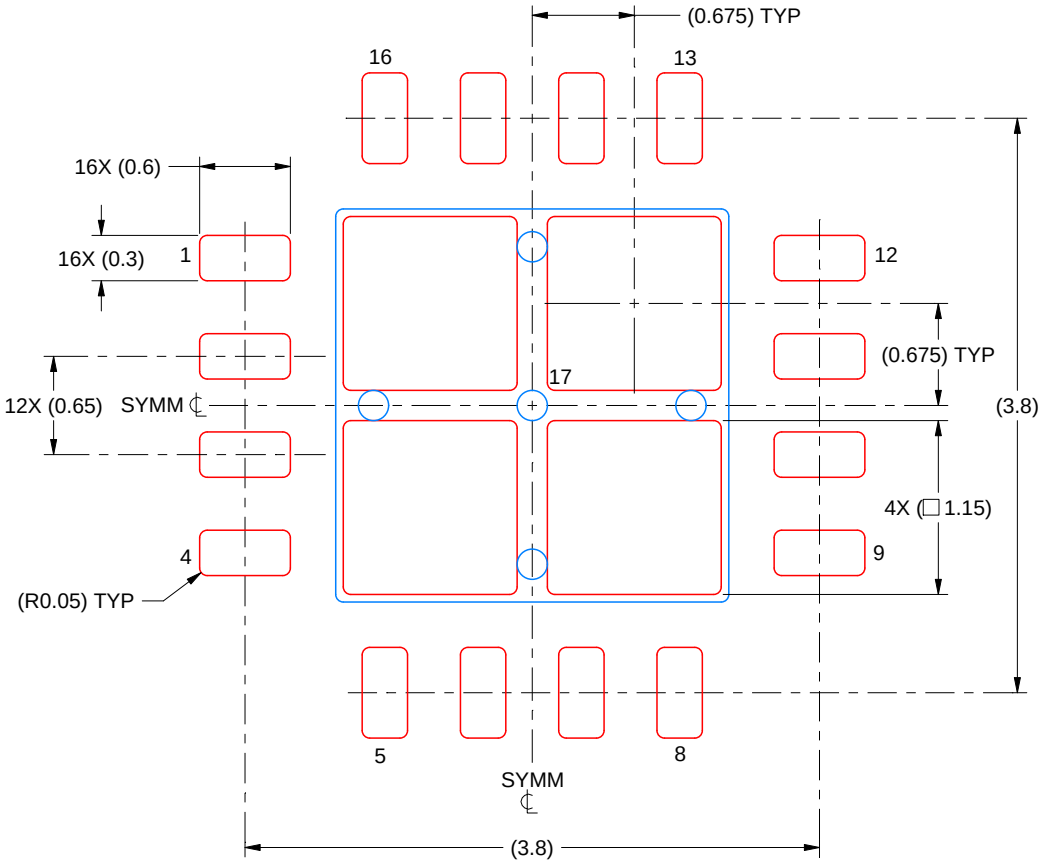
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
5. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown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

4214998/A 11/2021

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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