

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

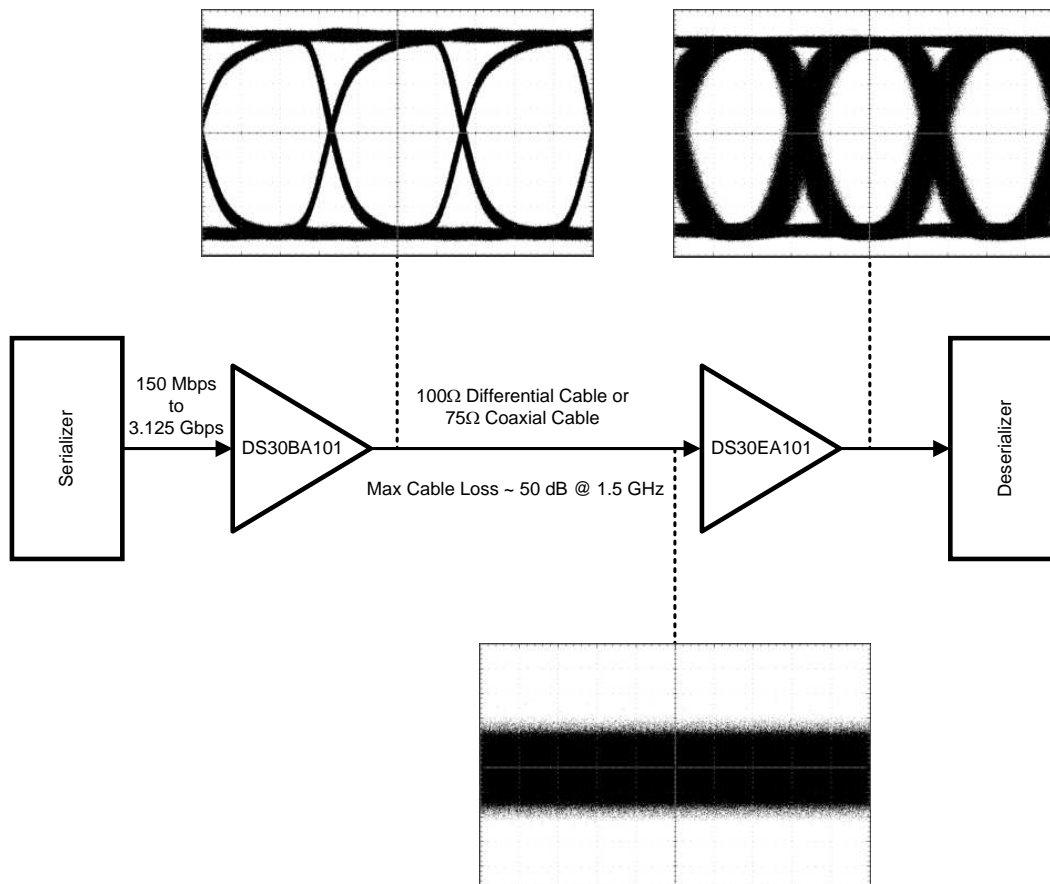
DESCRIPTION

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.

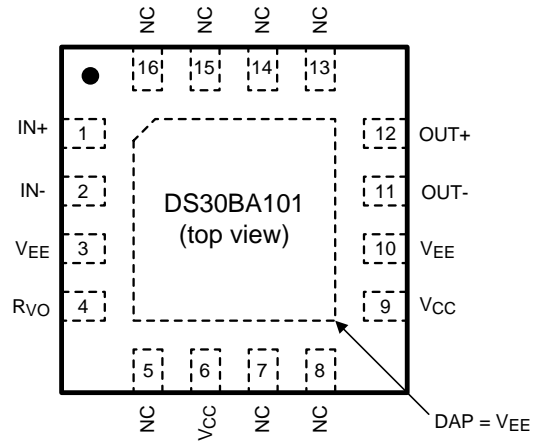
Typical Application



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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)	$\geq \pm 4.5$ kV
ESD Rating (MM)	$\geq \pm 250V$
ESD Rating (CDM)	$\geq \pm 2$ kV

- (1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may 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 $\pm 5\%$
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, 75 Ω load, $R_{VO} = 750\Omega$			800		mV _{P-P}
		Single-ended, 50 Ω load, $R_{VO} = 953\Omega$			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 $V_{CC} = +3.3V$, $T_A = +25^\circ C$, 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 $V_{CC} = +3.3V$, $T_A = +25^\circ C$, 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.

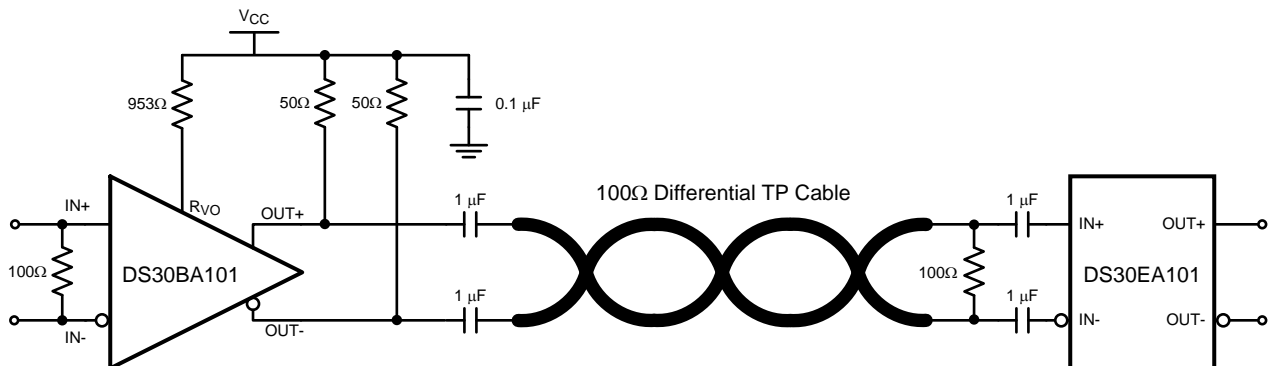


Figure 2. Cable Extender Chipset Application Circuit for 100Ω Differential Cable

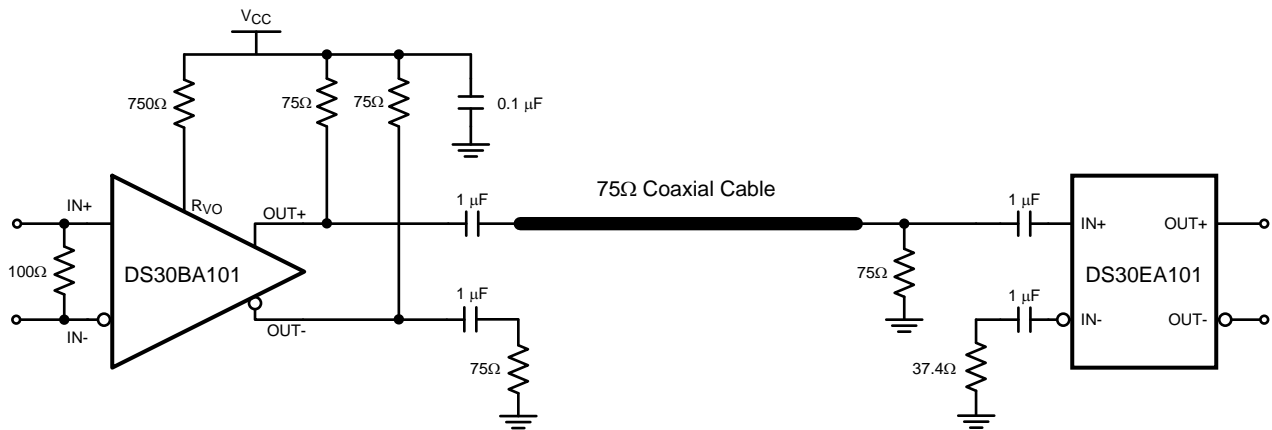


Figure 3. Cable Extender Chipset Application Circuit for 75Ω Coaxial Cable

REVISION HISTORY

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

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
DS30BA101SQ/NOPB	ACTIVE	WQFN	RUM	16	1000	RoHS & Green	SN	Level-3-260C-168 HR	-40 to 85	30BA101	Samples
DS30BA101SQE/NOPB	ACTIVE	WQFN	RUM	16	250	RoHS & Green	SN	Level-3-260C-168 HR	-40 to 85	30BA101	Samples
DS30BA101SQX/NOPB	ACTIVE	WQFN	RUM	16	4500	RoHS & Green	SN	Level-3-260C-168 HR	-40 to 85	30BA101	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.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device 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 Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

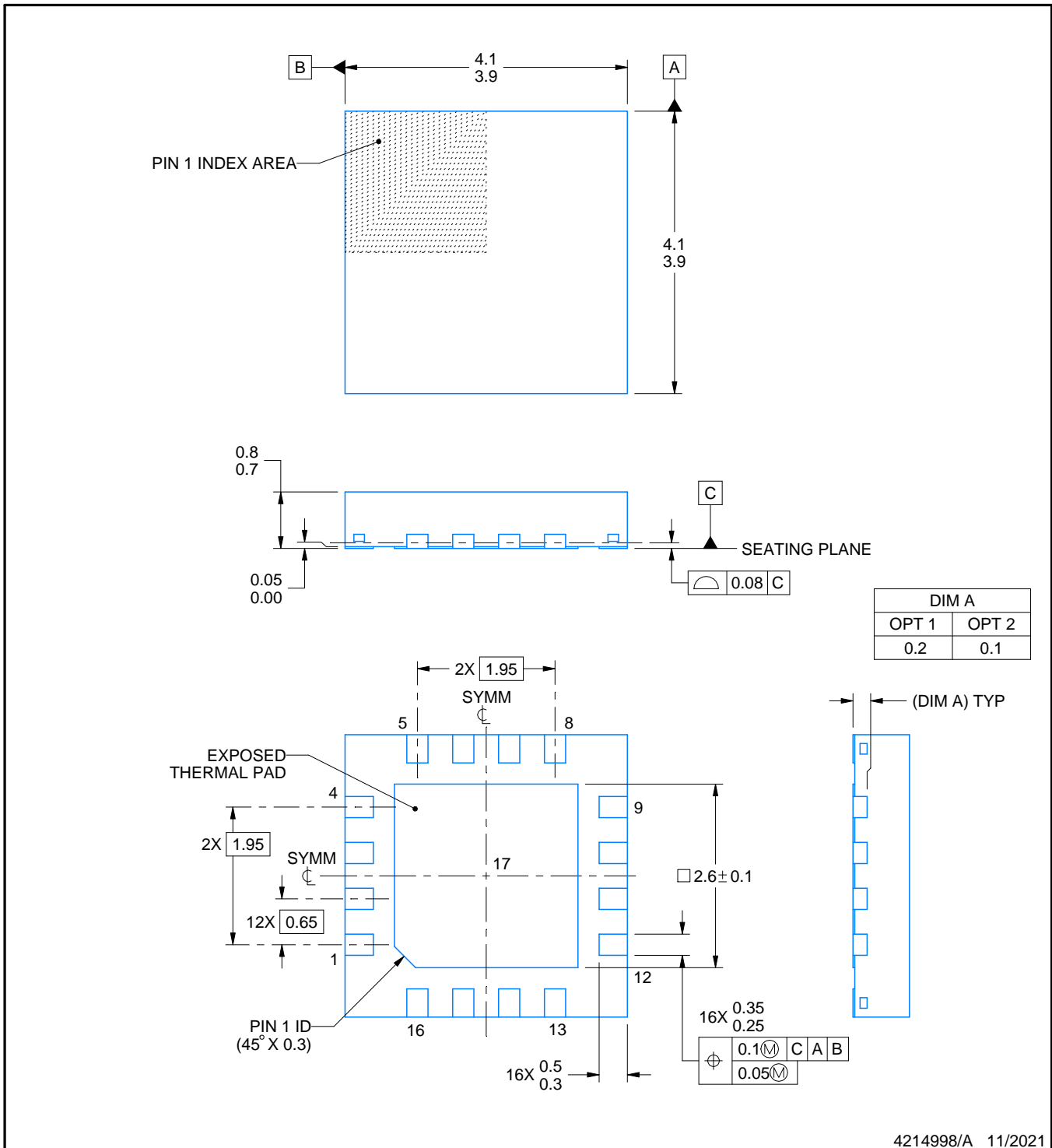
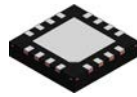

*All dimensions are nominal

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
DS30BA101SQ/NOPB	WQFN	RUM	16	1000	178.0	12.4	4.3	4.3	1.3	8.0	12.0	Q1
DS30BA101SQE/NOPB	WQFN	RUM	16	250	178.0	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	853.0	449.0	35.0



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NOTES:

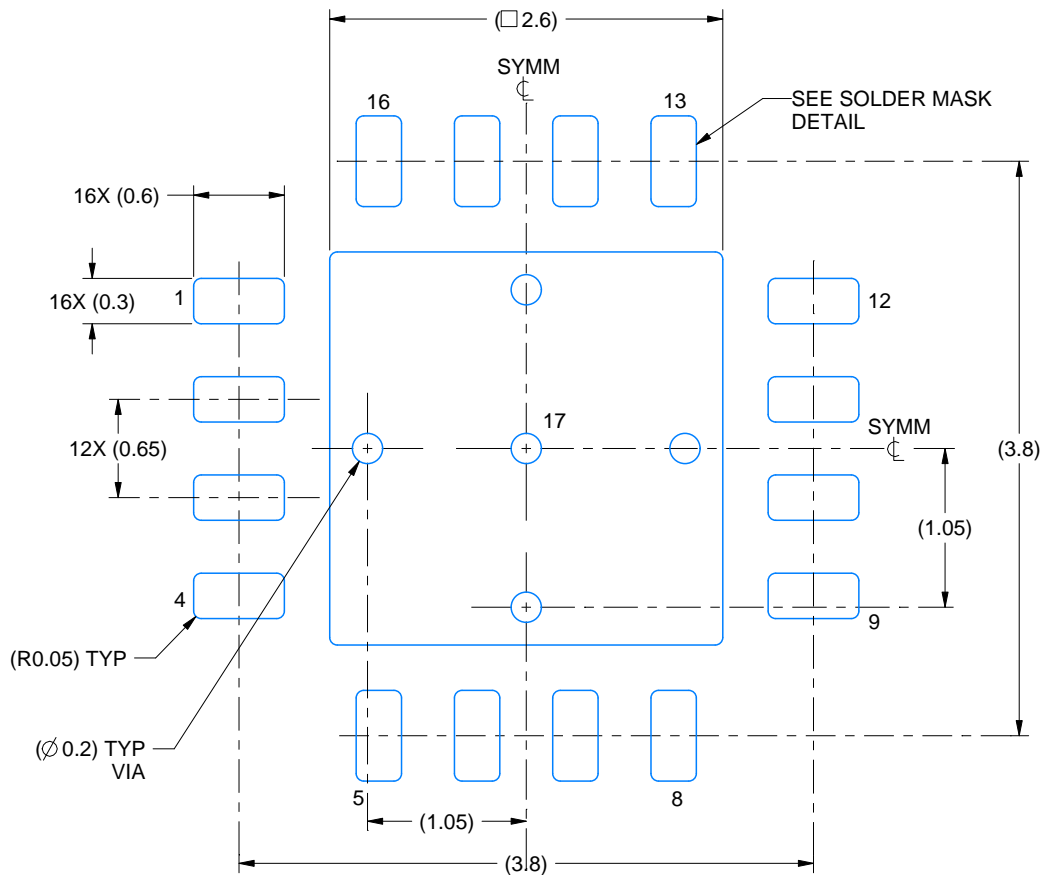
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

EXAMPLE BOARD LAYOUT

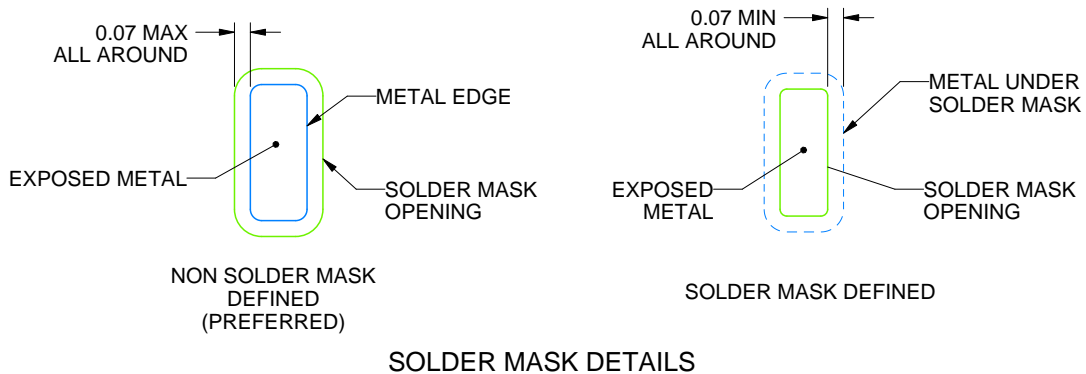
RUM0016A

WQFN - 0.8 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 20X



SOLDER MASK DETAILS

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NOTES: (continued)

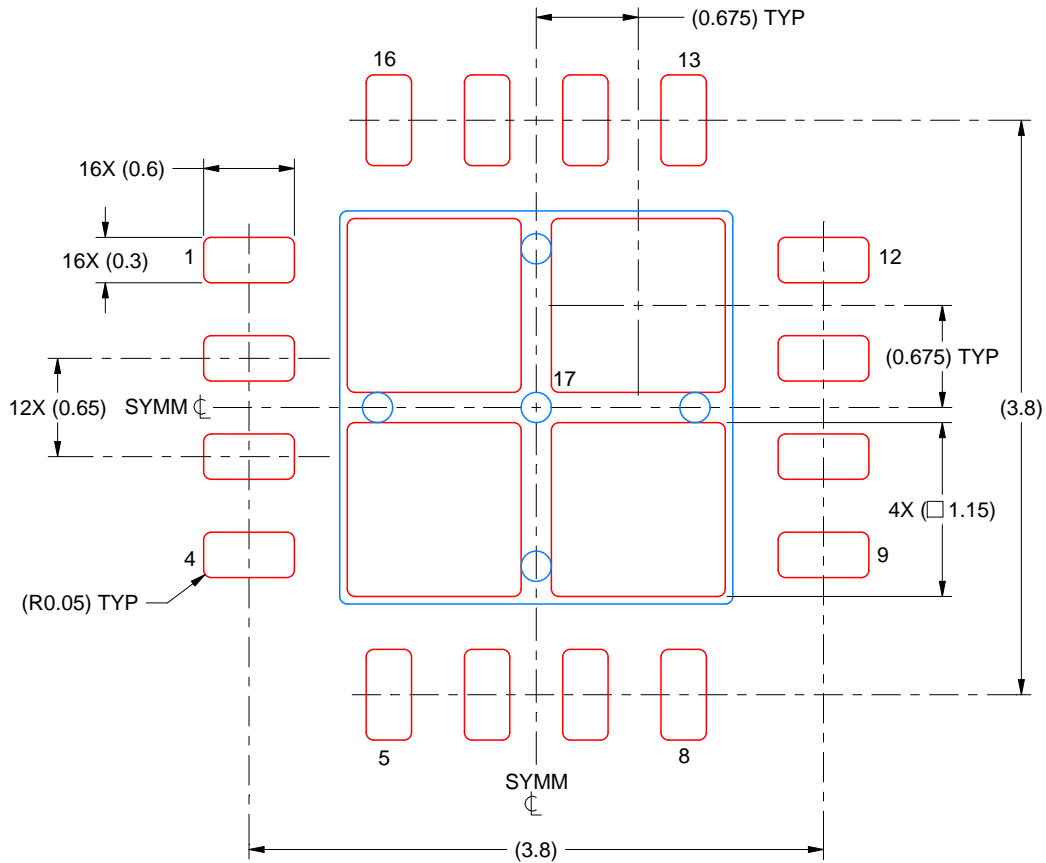
- This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/sluea271).
- Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown 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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