DS90UB981-Q1 4K DSI to FPD-Link IV Bridge Serializer

1 Features

- Single or dual port MIPI DSI receiver
  - Compliant to D-PHY v1.2 and DSI v1.3.1
  - Packed 16/18/24/30-bit RGB and 16-bit YCbCr
  - Loosely packed 18-bit RGB and 20-bit 4:2:2
  - 1 clock lane and 1-4 configurable data lanes per D-PHY Port
  - Up to 2.5 Gbps/lane with skew calibration
  - Supports data lane swap and polarity inversion
  - Supports both burst and non-burst mode
  - SuperFrame Unpacking Capability
  - Suitable for 4K at 60Hz video resolution
- FPD-Link IV interface
  - Supports 10.8/6.75/3.375Gbps per channel; Up to 21.6Gbps over dual channels
  - Coax/STP interconnect support
  - Port Splitting to enable Y-cable interfaces
- Ultra-low latency control channel
  - Two I2C up to 1MHz (up to 3.4MHz for local bus access)
  - High speed GPIOs
- Backwards compatible
  - 720P 92x and 1080P/2K 94x product families
  - ADAS 936, 954, 960, 962, 9702, 9722 deserializers
- Security and diagnostics
  - Voltage and temperature monitoring
  - Line Fault Detection
  - BIST and pattern generation
  - CRC and error diagnostics
  - Unique ID for counterfeit protection
  - ECC on control bits
- Advanced link robustness and EMC control
  - Data scrambling
  - Spread spectrum clocking generation (SSCG)
- Low power operation
  - 1.8V and 1.1V dual power supply
- AEC-Q100 qualified for automotive applications
  - AEC-Q100 grade-level 2: −40°C to +105°C
  - 64 pin QFN Wettable flanks 9mm x 9mm
  - ISO 10605 and IEC 61000-4-2 ESD compliant

2 Applications

- Automotive displays:
  - Central Information Displays (CID)
  - Rear Seat Entertainment (RSE)
  - Digital instrument clusters
  - Head units and HMI modules
  - Head Up Display (HUD)
  - Rear view and side mirror displays

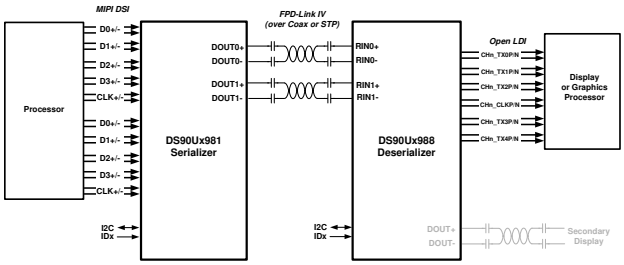
3 Description

DS90UB981-Q1 is a MIPI DSI to FPD-Link III/IV bridge device. In conjunction with an FPD-Link IV deserializer, the chipset provides a high-speed serialized interface over low-cost 50Ω coax or STP cables. The DS90UB981-Q1 is a D-PHY v1.2 compliant device that serializes a MIPI DSI input supporting video resolutions including 4K with 30-bit color depth. The FPD-Link IV interface supports video and audio data transmission and full duplex control, including I2C and GPIO data over a single channel or dual channels. Consolidation of video data and control over two FPD-Link IV lanes reduces the interconnect size and weight and simplifies system design. EMI is minimized by the use of low voltage differential signaling, data scrambling, SSCG, and randomization. In backward compatible mode, the devices supports up to 720p and 1080p resolutions with 24-bit color depth over a single/dual link. In ADAS compatible mode, the device is interoperable with 936, 95x, 96x & 97x deserializers supporting resolutions up to 8MP+/ 40fps.

Package Information

PART NUMBER	PACKAGE (1)	PACKAGE SIZE(2)
DS90UB981-Q1	RTD (VQFNP, 64)	9.00mm × 9.00mm

(1) For all available packages, see Section 6.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Simplified Application Diagram

Table of Contents

4 Device and Documentation Support

4.1 Documentation Support

4.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, *Soldering Specifications* application note
- Texas Instruments, *Semiconductor and IC Package Thermal Metrics* application note
- Texas Instruments, *Leadless Leadframe Package (LLP)* application note
- Texas Instruments, *LVDS Owner's Manual*
- Texas Instruments, *I2C Communication Over FPD-Link III with Bidirectional Control Channel* application note
- Texas Instruments, *Exploring the Internal Test Pattern Generation Feature of 720p FPD-Link III Devices* application note
- Texas Instruments, *I2C Bus Pullup Resistor Calculation* application note
- Texas Instruments FPD-Link Learning Center, *FPD-Link Fundamental Material* video series
- Texas Instruments, *Ten tips for successfully designing with automotive EMC/EMI requirements*
- Texas Instruments, *Serial Line-Fault Detection* (Contact TI)

4.2 Trademarks

All trademarks are the property of their respective owners.

4.3 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

4.4 Glossary

TI Glossary — This glossary lists and explains terms, acronyms, and definitions.

5 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

DATE	REVISION	NOTES
February 2024	*	Initial Release

6 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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
DS90UB981RTDRQ1	ACTIVE	VQFN	RTD	64	2000	RoHS & Green	Call TI | NIPDAUAG	Level-3-260C-168 HR	-40 to 105	UB981	Samples
DS90UB981RTDTQ1	ACTIVE	VQFN	RTD	64	250	RoHS & Green	NIPDAUAG	Level-3-260C-168 HR	-40 to 105	UB981	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) **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.

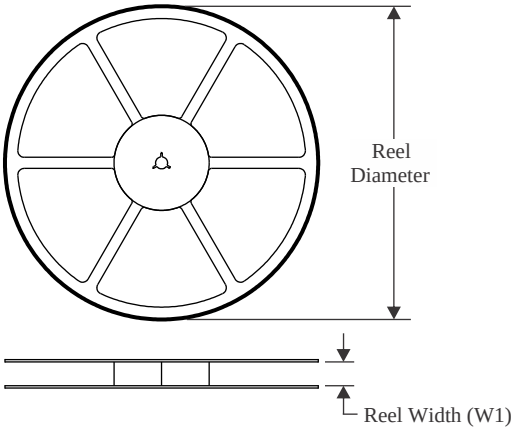
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

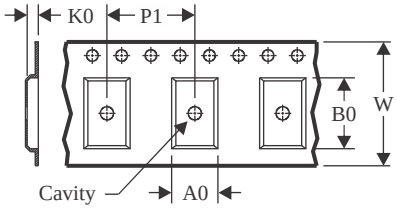
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

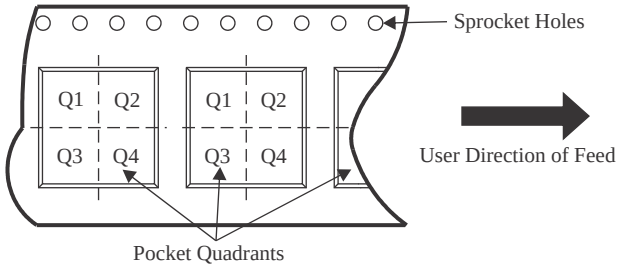


TAPE DIMENSIONS



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

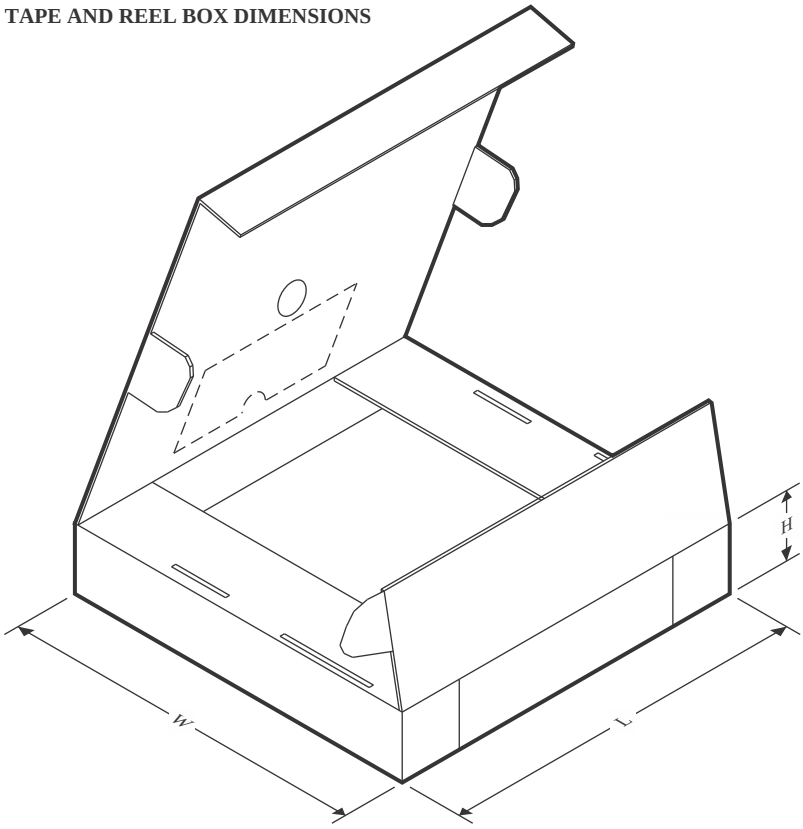
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
DS90UB981RTDTQ1	VQFN	RTD	64	250	180.0	16.4	9.3	9.3	1.1	12.0	16.0	Q2

TAPE AND REEL BOX DIMENSIONS



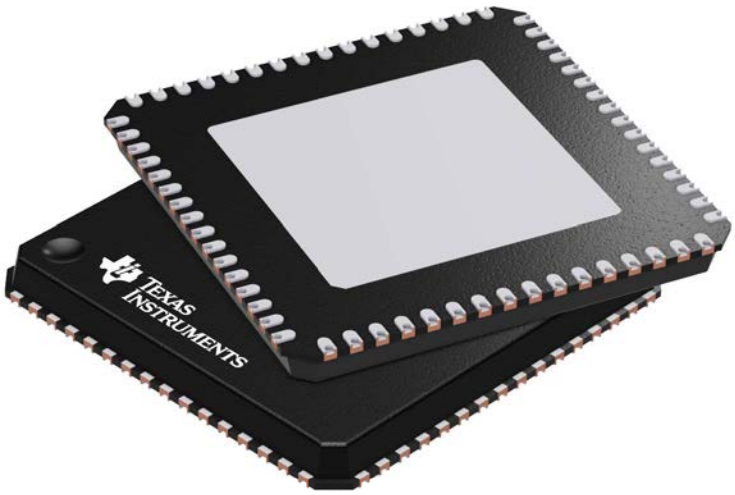
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DS90UB981RTDTQ1	VQFN	RTD	64	250	210.0	185.0	35.0

GENERIC PACKAGE VIEW

RTD 64 VQFNP - 0.9 mm max height

PLASTIC QUAD FLATPACK - NO LEAD



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265