Cable Requirements for the DS90UB913A & DS90UB914A

Mark Sauerwald

ABSTRACT

The DS90UB913A and DS90UB914A chipset transports serialized video data over coaxial cables. A variety of cable assemblies meeting this generic description are available on the market, and not all perform equally. This document defines the cable characteristics required to properly support the high speed serial data transfer from a DS90UB913A serializer to a DS90UB914A deserializer. Three key parameters are described: insertion loss, return loss, and impedance. These requirements are for the entire interconnect system, including connectors, and cable. In addition, this application note provides some recommended handling characteristics for the cable.

Contents

1   Overview of the Operation of the DS90UB913A

1.1   Forward Channel

The data that the DS90UB913A receives from the imager is encoded and serialized. The encoded word (payload) is 14 bits long, so for each PCLK, there are 14 bit cells output from the DS90UB913A. This means that with a 100MHz PCLK, the serial rate out of the serializer is 1.4 Gbps, which corresponds to a bandwidth requirement of 700MHz, or a unit interval time of 714ps.

1.2   Back Channel

The back channel operates within a frequency band that is nominally centered at 2.5MHz, but it can change with process variation, power supply and temperature. The back channel frequency is kept low to minimize any potential interference with the forward channel. The back channel frequency is fixed, and does not scale with the PCLK frequency, so the backchannel frequency needs to be much lower than the slowest acceptable PCLK frequency.

1.3   Power Over Coax

In addition to the forward and backchannel data, the coax cable is often asked to carry power to the camera as well. When operating in this mode, the DC impedance of the cable is important as high DC impedance will lead to losses in the cable which may make powering the imager and serializer more difficult.

2 Cable Requirements

2.1 Insertion Loss

The DS90UB913A/914A are sensitive to insertion loss over the band from 1MHz to 700MHz. Within this range, the dominant loss is through the skin effect, so it is generally proportional to the square root of the frequency. The DS90UB914A has an adaptive equalizer at its input which allows it to compensate for various lengths of cable, provided the total attenuation stays within maximum allowable limits. Table 1 shows the maximum allowable insertion loss at a variety of frequencies.

Table 1. Maximum Cable/Connector Insertion Loss

Frequency (MHz)	Attenuation (dB)
50	1.0
100	1.4
200	5.3
400	7.6
700	10

2.2 Return Loss

Return Loss is the loss of the signal power resulting from a discontinuity in the characteristic impedance of the transmission line, and is most commonly encountered at the interface of one portion of the transmission line and another – such as the connector to a cable or board. Return Loss has been historically represented in dB as a negative number and we retain this convention here.

For reliable operation of the DS90UB913A and DS90UB914A the return loss must be less than -10dB for frequencies from 10MHz to 1GHz.

2.3 Characteristic Impedance

The DS90UB913A and DS90UB914A are designed to operate with 50Ω coaxial cable. It is recommended that the cable used in a system be nominally 50Ω characteristic impedance +/- 5%. If Power over Coax is going to be used, then the DC resistance of the cable should also be considered. TI reference designs assume that the center conductor DC resistance is < 8Ω for a 10m length of cable. If a cable with greater DC resistance is used, then the Power over Coax design may need to be reconsidered to accommodate this. Typically if the voltage sent over the cable is increased, then the DC drop is lessened and becomes less critical.

2.4 Mechanical Handling

The characteristics of coaxial cable can be adversely affected by handling, therefore it is recommended that the pulling tension when pulling cable through conduit or other areas be less than 53N, and that the bend radius not be less than 25mm.

3 Revision History

DATE	REVISION	NOTES
March 2015	*	Initial release.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have *not* been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		Applications	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		