MOST

Media **O**riented **S**ystems **T**ransport

Multimedia and Control
Networking Technology

MOST Application Note
Optical Physical Layer
Rev 1.0
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Document References

All documents, which are referenced by this MOST document, are listed here along with their versions.

Number	Document	Revision
1	MOST Physical Layer Specification	1.1
2	MOST Specification of Physical Layer Rev 1.1 Addendum A	1.0
3	MOST Specification of Physical Layer Rev 1.1 Addendum B	1.0

Document History

Changes MOST Application Note oPhy xVx-xx to MOST Application Note yVy-yy

Change Ref.	Section	Changes

1 Introduction

The optical physical interface of a MOST device must be designed to conform to the *MOST Physical Layer Specification*. In this document, the following aspects of the optical physical interface are discussed:

- Optical Power Switch
- Phase Jitter
- Integrated vs. Flexible Pigtails
- Optical Power Budget

During the development of the optical physical interface, the design rules and practices presented in this document should be closely considered as they influence the locking behavior of the MOST Network.

2 Overview of the Optical Physical Interface

Each MOST device communicates on the MOST Network via an optical physical interface. This physical interface consists of an optical receiver and an optical transmitter.
Optical data from the MOST Network is received at the physical interface and converted to an electrical bit stream before being sent to the MOST Network Controller (on the **Rx** line). In the same manner, the physical interface accepts an electrical bit stream from the MOST Network Controller (on the **Tx** line) and transmits it as optical data on the MOST Network.

The optical transmitter should be powered from a switched supply that can be shutdown when not needed; however, the optical receiver requires continuous power for its internal activity detection logic. When this logic detects light on the MOST Network, a status signal (**/Status**) is driven low. This signal can be used to enable other supplies on the MOST device, including the switched power to the optical transmitter. During periods without network activity, the optical receiver enters a low power mode (minimized power consumption is mandatory) and only the activity detection logic remains powered. During this time, the **/Status** signal is driven high.

Figure 2-1illustrates the arrangement of the optical physical interface in a typical MOST device. In this figure, continuous power is shown as Vcnt and switched power is shown as Vsw. Other signals discussed in subsequent chapters are also shown this figure.

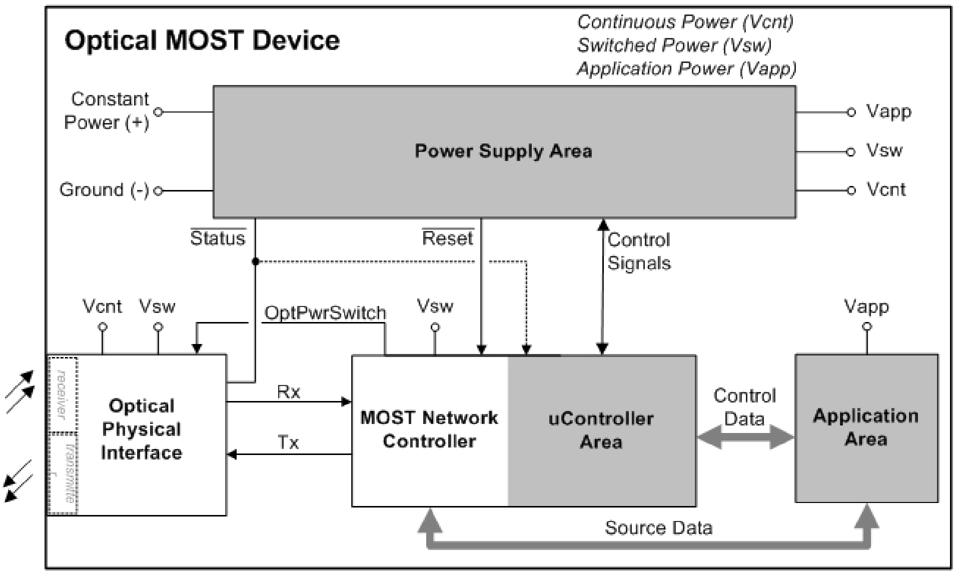

Figure 2-1: Typical MOST Device Arrangement

3 Optical Power Control

In automotive systems, optical output power control is required on all MOST devices. The circuitry resides between the MOST Network Controller and optical transmitter, and serves to switch the optical output between full power and –3 dB.

During diagnostic tests, a simple and efficient means of assessing the optical power budget is reducing optical output by 3 dB and verifying the system continues to operate correctly. This function is intended for diagnostic purposes only and full optical power is required under normal operating conditions.

Optical power can be controlled by the uController via the **OptPwrSwitch** signal. A typical implementation of optical power control is the use of **OptPwrSwitch** to reduce driver current to the optical transmitter by half (3 dB power) during the diagnostic test. When not driven by the uController, this signal must enable maximum driver current (full optical power).

Optical output signal parameters (SP2) of the *MOST Physical Layer Specification* are applicable to MOST devices with full optical power. No timing-performance or optical pulse characteristics are explicitly set forth for devices operating at reduced power; however, driver design should guarantee that an electrical data pattern is transferred identically at the optical output, regardless of the **OptPwrSwitch** setting.

Figure 3-1 shows a typical implementation of the optical power switch circuitry within the optical physical interface area. Actual implementations may vary, based on specific requirements of the components used.

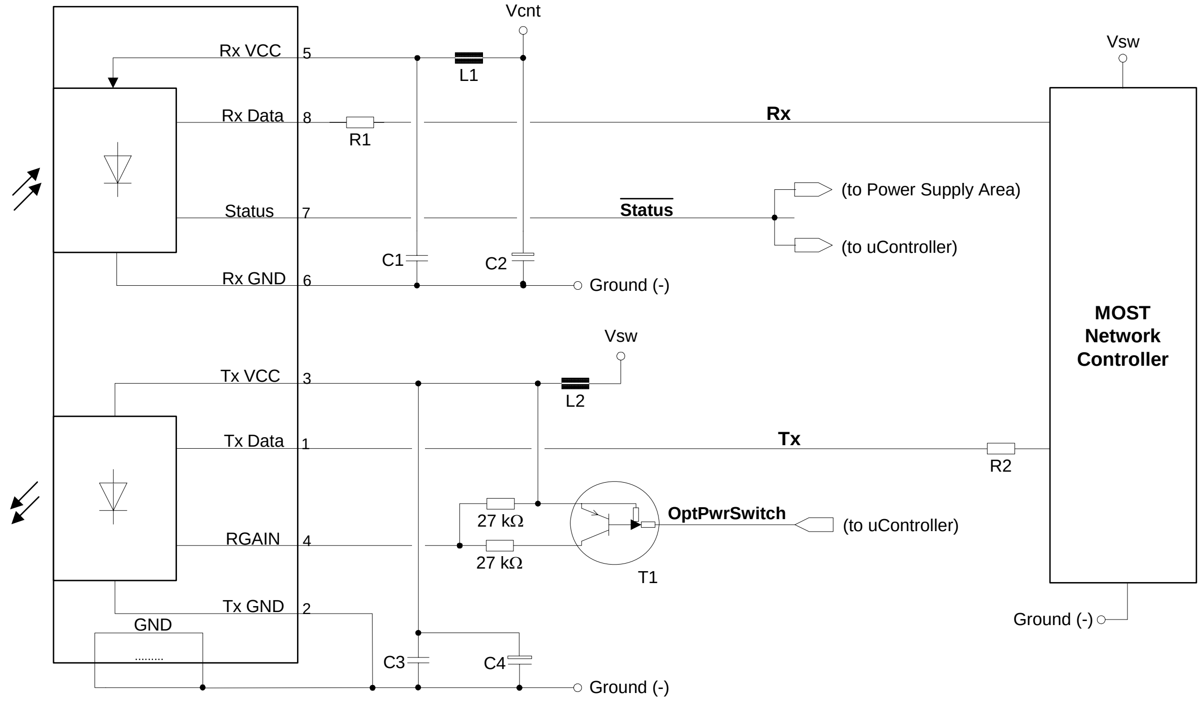

Figure 3-1: Typical Implementation of Optical Power Control

NOTE: The optical power switch implementation must enable full power when the uController is inactive (**OptPwrSwitch** not driven).

4 Phase Jitter

Phase jitter can accumulate as it passes through nodes on the MOST Network; therefore, it is important that phase jitter be minimized at the physical interface of each MOST device. To minimize interference and cross-talk on the data lines, it is important to consider:

- the use of series resistors on the data lines between the MOST Network Controller and the optical receiver/transmitter, and
- strategic component placement and layout techniques on the PCB.

Large IO currents between the optical transmitter/receiver and the MOST Network Controller may occur under certain power-up conditions; therefore, resistor values should be carefully chosen to ensure current does not exceed the data sheet limits of the connected devices. Placement of the series resistors is also important, with each series resistor residing as close as possible to the transmitting device.

Layout of the PCB influences signal integrity and should be optimized. When designing the optical physical interface of a MOST device, special consideration should be given to the following:

- Slew rates of the data signals (**Rx**, **Tx**) should be considered; therefore, the distance between the optical transmitter/receiver and the MOST Network Controller should be minimized.
- An HF ground plane should be placed beneath the optical transmitter, the optical receiver and the data lines (**Rx**, **Tx**). Additionally, the ground planes beneath the transmitter and receiver must be connected together.
- Bypass capacitors at the optical transmitter/receiver must connect to the point where the ground planes beneath the transmitter and receiver are connected.
- Data lines (**Rx**, **Tx**) should be placed as far apart as possible and separated by a ground area.
- The shielding box of the optical connector must be soldered to the ground plane.
- The power supply of the optical physical interface must be buffered and bypass capacitors should be placed as close as possible to the transmitter and receiver.
- Appropriate bulk capacitors (of ceramic type) should be used on each power supply.

NOTE: MOST devices transport data at high rates and low signal levels; therefore, it is important that general rules of high-frequency engineering are applied to the optical physical layer and the area surrounding the MOST Network Controller.

5 Options for the Optical Connection

Pigtails connect the optical transmitter/receiver to the MOST device connector (MOST Network socket). Two common types of pigtails are currently used in optical physical interfaces: *integrated* pigtails and *flexible* pigtails. Other solutions are possible; however, the mechanical interface (MOST Network socket) is standardized. When developing a MOST device, the advantages of various types of pigtails should be considered.

Integrated pigtails consist of the optical transmitter and receiver, as well as the MOST Network socket. With this implementation, the transmission path of the optical data (from the socket to the optical transmitter/receiver) is minimized. This reduces the length of the polymer optical fiber (POF) used or allows the use of some other optical guide (e.g. lens).

The integrated pigtail is placed at the edge of the PCB, allowing a MOST Network connection at the edge of the MOST device. The optical data is converted to an electrical bit stream at this location. Integrated pigtails offer the following advantages:

- Potential for higher optical power budget
- Small dimensions
- Commercial aspects

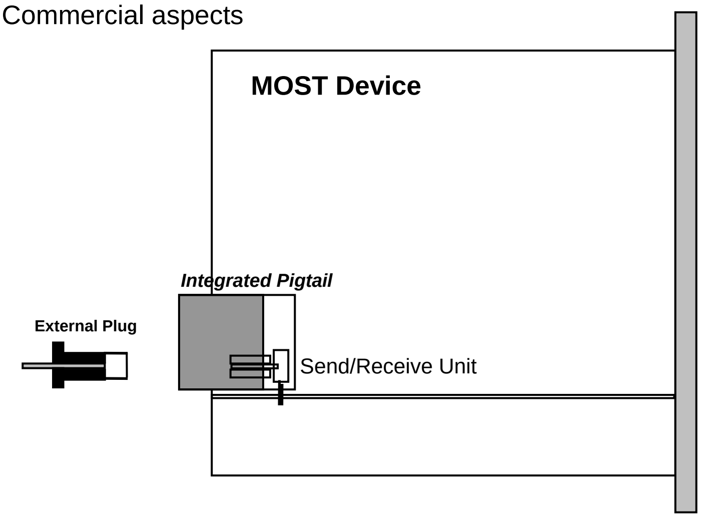

Figure 5-1: Integrated Pigtail Example

In flexible pigtails, the MOST Network socket is placed at the edge of the PCB to allow positioning the MOST Network connection at the edge of the MOST device. The optical data is then routed to some other location within the MOST device (via POF) before connecting to the optical transmitter/receiver and being converted to an electrical bit stream. Flexible pigtails offer the following advantages:

- Reduces EMI problems
- Flexible placement of the optical physical interface and the MOST Network Controller on the PCB
- Small dimensions
- Decoupling of the MOST Network socket from the optical transmitter/receiver case

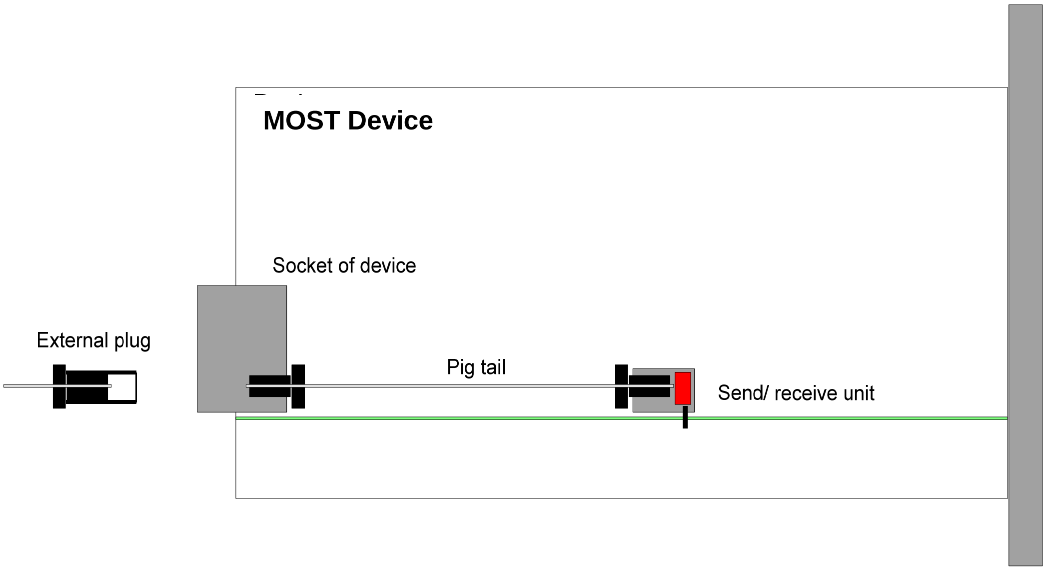

Figure 5-2: Flexible Pigtail Example

On a single MOST device, several optical physical interfaces may be implemented for test purposes. Placing multiple optical connectors and electrical connectors on a MOST device allows various pigtail options to be evaluated on a single prototype device.

6 Optical Power Budget

An important parameter of a MOST system is the optical power budget of each link, which strongly influences the locking behavior of the network.

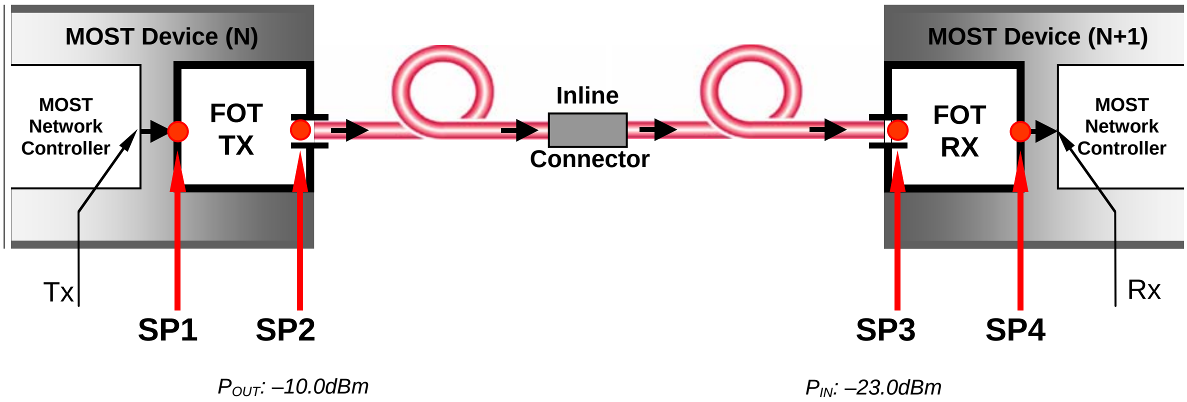

Figure 6-1: Optical link between two MOST Devices

The *MOST Physical Layer Specification* (V1.1) sets forth the following optical output power and sensitivity limits for a MOST device:

Minimal optical output power (at SP2)	–10.0 dBm
Minimal sensitivity (at SP3)	–23.0 dBm

Based on these values, the resulting optical power budget of a MOST device is 13 dB. Therefore, the sum of all loss within an optical link (e.g., between two MOST devices) must be less than 13 dB.

An example of total loss in an optical link is shown below. These values are worst-case losses for typical products. When calculating the loss for an actual optical link, these values should be obtained from the product data sheets. OEMs perform calculations of this nature.

Loss within fiber per meter (including spectral influences)	0.3 dB/m
Maximum loss of *Inline Connector*	2.0 dB
Loss at MOST device connector (two per link)	2.5 dB ∗ 2
Loss due to fiber aging and manufacturing tolerances (OEM specific)	4 dB
Sum of all loss within optical link (worst-case)	11 dB + (x ∗ 0.3 dB/m) where, x = fiber length [m]

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