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## **RF Interface Connection between Surface Mount Driver Amplifier and Connectorized GPPO Type of Optical Modulator**

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Microsemi products achieve high levels of performance in part due to a carefully designed interface between external connectors and internal components. As a result, specific handling precautions must be observed for device reliability and optimum performance.

### **Scope**

This document outlines one of the solutions available for the RF interface connection between Microsemi's surface mount technology (SMT) optical modulator driver amplifier and connectorized GPPO-compatible optical modulator.

### **Introduction**

Microsemi designs and manufactures driver amplifiers in “gold brick” connectorized module and in surface mount technology (SMT) package.

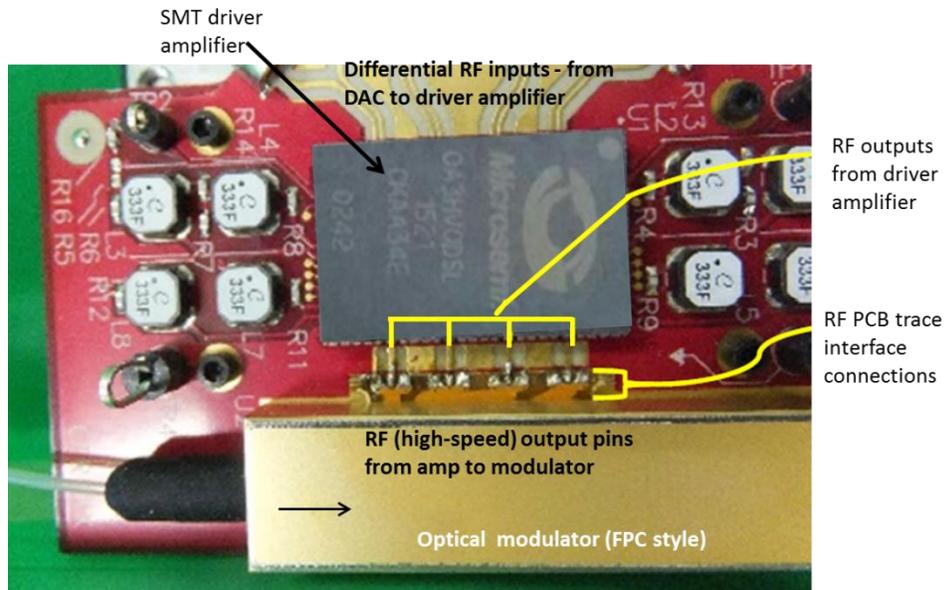
Typically, there are three available options of RF interface connections between driver amplifier and optical modulator package.

- Option 1: Connectorized driver amplifier module to connectorized optical modulator, by using RF cables as the RF interface connection.
- Option 2: Driver amplifier in SMT package to FPC style (i.e., surface mount high-speed pins) of optical modulator, by using controlled impedance of the PCB traces for the RF interface connection as shown in Figure 1.
- Option 3: Driver amplifier in SMT package to GPPO connectorized optical modulator, by using a surface mount pin to GPPO-compatible connector interface, as shown in Figure 7.

In this application note we will mainly focus on the RF interface connection between the driver amplifier in an SMT package and the connectorized GPPO optical modulator package, (i.e., option 3 above).

### **Typical RF Interface between SMT Driver Amplifier and FPC Style of Optical Modulator**

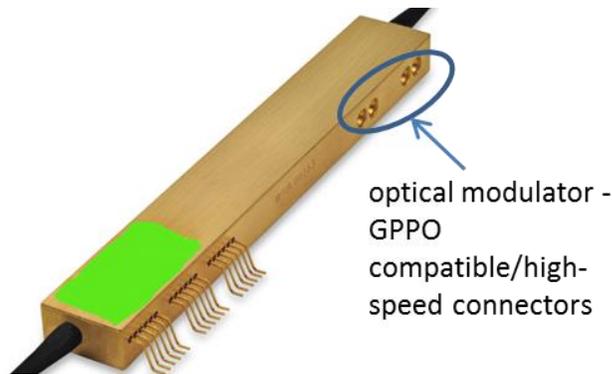
Figure 1 shows a typical RF (a.k.a., high-speed) interface between the Microsemi SMT driver amplifier and an optical modulator with surface mount RF (high-speed) pins, by using controlled PCB trace impedance line (e.g., 50 ohm) for the RF interconnection. This type of RF interface connection will give the best RF performance, but the optical modulator is more expensive compared to a connectorized version.



**Figure 1: Example of RF (high-speed) interface connection between a surface mount driver amplifier and a FPC style of optical modulator (high-speed surface mount RF interface connections)**

### Typical Connectorized Optical Modulator

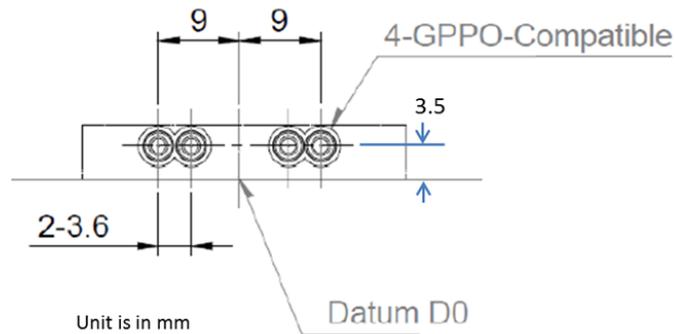
If the intended design uses a SMT driver amplifier and a connectorized GPPO version of optical modulator, (see Figure 2 for an example of the connectorized optical modulator), you will need a surface mount to GPPO-compatible connector interface.



**Figure 2: Example of connectorized GPPO version of optical modulator**

### OIF Outline of the “2+2 GPPO-Compatible” Connection Interface

Most off-the-shelf connectorized GPPO-compatible optical modulators mechanical RF (high speed) connection interface is per the Optical Internetworking Forum (OIF) document, Implementation Agreement (IA) # OIF-PMO-TX-01.1, dated August 27, 2013, (see drawing outline in Figure 3). Any 4-position 2+2 surface mount to GPPO-compatible connector that meets the mechanical specification in the OIF-PMO-TX-01.01 document will work for the RF transition interface between SMT driver amplifier and connectorized GPPO-compatible optical modulator.



**Figure 3: Mechanical specification of the “2+2 GPPO-compatible” high-speed (RF) interface as outlined in OIF doc IA # OIF-PMO-TX-01.1**

### 4-Position 2+2 GPPO-Compatible Connectors

Table 1 below lists two manufacturers offering a PCB surface mount to GPPO-compatible 4-position 2+2 connector, compatible per OIF doc IA # OIF-PMO-TX-01.1. There are other manufacturers; it is recommended that the user survey all the available RF connectors to select the optimum connector for your system performance needs. Figure 4 shows an example of a 4-position 2+2 GPPO-compatible (male) to PCB surface mount connector assembly.

**Table 1**

Manufacturer name	Mfg website	Mfg part number	Description
Carlisle Interconnect Technologies	www.carlisleit.com	P100-AMT-4CC	SSMP® male detent PCB surface mount 4 positions
Carlisle Interconnect Technologies	www.carlisleit.com	P100-AMT-1CC	SSMP® male smooth bore PCB surface mount 4 positions
Corning Gilbert Inc.	www.corning.com/gilbert	OL-SK-4945-FD	GPPO® male R/A 4 position SMT block (full detent)
Corning Gilbert Inc.	www.corning.com/gilbert	OL-SK-4945-SB	GPPO® male R/A 4 position SMT block (smooth bore)

Notes:

1. SSMP® connector is compatible with GPPO® connector.
2. SSMP® is registered trademark of Carlisle IT.
3. GPPO® is registered trademark of Corning Gilbert.
4. For technical specification and mechanical drawing of those connector assemblies, please contact the respective connector manufacturer.



**Figure 4: 4-position 2+2 GPPO-compatible PCB surface mount connector assembly**

Per RF connector manufacturer, typical RF performance for this type of connector has the following characteristic:

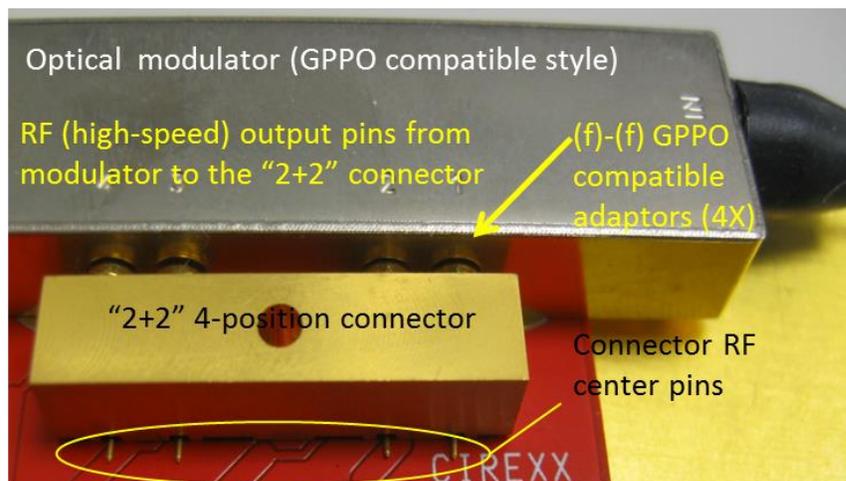
- 50 ohms impedance
- Frequency range: DC to 33 GHz
- Return Loss: ~20 dB to 18 GHz, ~12 dB to 33 GHz, (typical)
- GPPO-compatible connector
- Compatible to the 2+2 mechanical specification requirements in OIF IA # OIF-PMO-TX-01.1

The 4-position 2+2 connector is easier to “assemble-to”, between the optical modulator’s high-speed (RF) connector interfaces and the 4-position 2+2 connector assembly, (i.e., relative to perpendicular alignment interface between all four connections when the 4-position 2+2 connector is soldered down onto the PCB) compared to using two separate, 2-port board mount connectors. If the RF connection interfaces are not seated properly, mismatch can occur, causing output eye performance issues.

Figure 5 shows an illustrated example of the RF interface connection using four female-to-female GPPO-compatible adaptors (or bullets) between the 4-position 2+2 connector and the optical modulator’s high-speed (RF) connector interface. In Figure 6 illustration, the center connector pins are not soldered down to the PCB, illustrating the contact relative spacing (z-axis) of the connector center pin to the PCB surface. The picture shows the 4-position 2+2 connector has the correct mechanical dimension to mate with the GPPO-compatible connector style of optical modulator and make contact with the PCB surface.



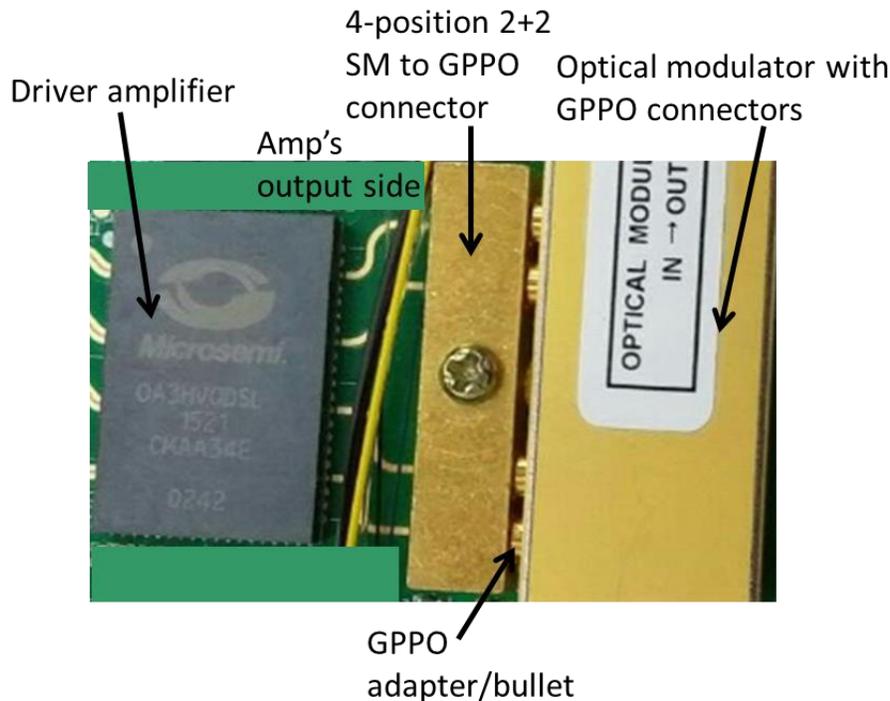
**Figure 5: 4-position 2+2 GPPO-compatible PCB surface mount connector assembly with GPPO-compatible bullets installed**



**Figure 6: Example of RF connection interface between 4-position 2+2 GPPO-compatible connector and optical modulator (illustration only)**

## Typical RF Interface between SMT Driver Amplifier and Connectorized Style of Optical Modulator

Figure 7 shows the overall interface connection (i.e., option 3) of the high-speed (RF) interface connection between a SMT driver amplifier and a connectorized optical modulator through a 4-position 2+2 GPPO-compatible connector assembly. Four GPPO-compatible female-to-female adaptors/bullets are used for the mating connection.



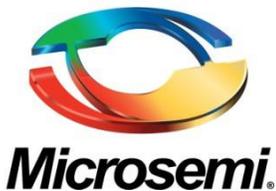
**Figure 7: Example of RF (high-speed) interface connection between a surface mount driver amplifier and connectorized style of optical modulator**

### PCB Connector Layout Design Note

The PCB surface mount connector layout pattern will be unique depending on the PCB material used. The trace width and trace spacing will depend on the PCB stack, (i.e., PCB layer thickness, copper plane thickness, dielectric material used, etc.) For optimized RF performance (i.e., port match), care must be taken with the PCB layout, including RF ground vias around the RF center pin of the connector. Keep the distance between the two RF interfaces (i.e., driver amplifier and RF connector) as short as possible length to minimize RF insertion loss. Another important factor on the PCB layout is to keep those four RF PCB traces to have the same electrical length for IQ performance. It is recommended to work with the connector manufacturer for proper RF connector PCB layout design pattern.

Note: A good ground solder connection on the 4-position 2+2 connector body also plays an important role for good output eye/RF performance. The connector will take time to come up to the proper soldering temperature; fine tune the solder reflow profile to ensure good solder connections on the driver amplifier and on the 4-position 2+2 GPPO-compatible connector.





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