O-band 40 GBaud InP  
DFB Laser Mach-Zehnder-Modulator  

General Description  
The Indium-Phosphide DFB laser Mach-Zehnder-Modulator is ideally suited for optical transport applications within the O-band. It features an integrated laser and an unique traveling-wave-electrode design, resulting in high bandwidth and zero chirp.

Applications  
40GBaud OOK, 4PAM, 2PSK

Features  
- O-band operation  
- Integrated DFB laser  
- Traveling-wave-electrode design with zero chirp  
- Adjustable $V_\pi$  
- Small foot print (8.0 x 0.5 x 0.2mm)  
- AR-coated output facet with spot size converter for efficient optical coupling

Operating Conditions / Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>°C</td>
<td>20</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Bias current $I$</td>
<td>mA</td>
<td>100</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Bias voltage $V_{bias}$</td>
<td>V</td>
<td>3</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Phase-voltage</td>
<td>V</td>
<td>-10</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Unit</th>
<th>Typ</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Power</td>
<td>$P_{out}$</td>
<td>dBm</td>
<td>4</td>
<td>@ max. transmission</td>
</tr>
<tr>
<td>Wavelength</td>
<td>$\lambda$</td>
<td>nm</td>
<td>1293</td>
<td>@ 100 mA, 20°C</td>
</tr>
<tr>
<td>Side mode suppression ratio</td>
<td>SMSR</td>
<td>dB</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Extinction ratio (DC)</td>
<td>$ER$</td>
<td>dB</td>
<td>&gt; 20</td>
<td>@ $V_{bias} = +5$ V</td>
</tr>
<tr>
<td>3dB EO cut-off frequency</td>
<td>$f_{3db}$</td>
<td>GHz</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Phase voltage</td>
<td>P1</td>
<td>P2</td>
<td>V</td>
<td>3</td>
</tr>
<tr>
<td>$V_\pi$</td>
<td></td>
<td>V</td>
<td>1.6</td>
<td>@ $V_{bias} = +5$ V</td>
</tr>
</tbody>
</table>

Small signal response (S21 eo)  

$V_\pi = f (V_{bias}) @ 1293$ nm  

HHI reserves the right to change specifications without any prior notice at any time
O-band 40 Gbaud InP
DFB Laser Mach-Zehnder-Modulator

General Instructions / Precautions
An InP-Mach-Zehnder-Modulator contains several semiconductor-p-i-n junctions, a faulty DC-operation will result in an irreversible damage of the device. Please use the electric circuit diagram for correct DC-wiring. Don’t exceed maximum values for Phase- and Bias-voltages. \( V_{\text{bias}} \) has to be always positive, referenced against GND. Phase voltages has to be always negative, referenced against \( V_{\text{bias}} \). Use voltage sources with integrated current limiter. The laser should not be connected to GND.

Limits: \( V_{\text{bias}} \): 3 mA, Phase: 1 mA, Laser: 2.5 V.

The use of an external temperature controller is highly recommended, otherwise the laser could be damaged and the operating point is not stable over time.

Connections / Specifications
• Optical coupling: SSMF with tapered fiber / lense recommended
• Contact-pad material: Au
• DC-pad dimensions: 85 x 85 \( \mu \text{m} \)
• RF-pitch: 150 \( \mu \text{m} \), external 50 \( \Omega \) needed for RF-operation
• Integrated heater for wavelength fine-tuning (H1, H2)

Device diagram

Electric circuit diagram

Chip dimensions [\( \mu \text{m} \)]

Part Number
• Chip: MZM_D_O_33_19

HHI reserves the right to change specifications without any prior notice at any time.

Contact: Klemens Janiak Phone: +49 30 31002-574 Mail: klemens.janiak@hhi.fraunhofer.de