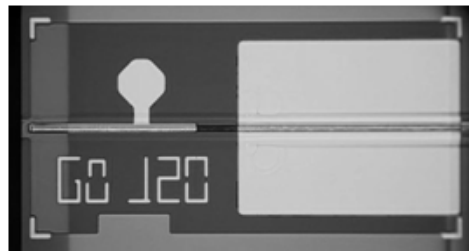
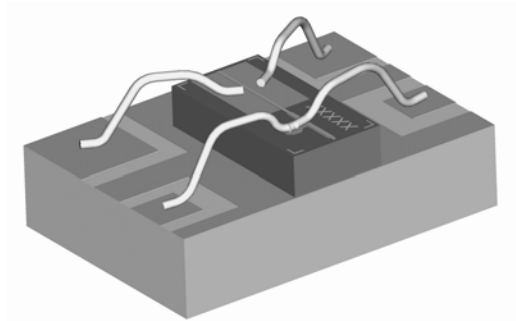


MC510 Series

Electro-absorption Modulated Laser Chip (with optional carrier)

1550nm Non-ITU and DWDM Wavelengths for Applications up to 12.5Gbps



MC510 is an electro-absorption modulated laser (EML) chip. The device, consisting of a DFB laser and an electro-absorption (EA) modulator, is an unbounded chip for use in a laser module with a thermal electric cooler. The EML chip or chip-on-carrier can be used as a cooled transmitter light source at 1550 nm or at DWDM channel wavelengths for data rates up to 12.5Gbps. It is available at ITU wavelength from 1527nm to 1563nm with 0.4nm (50 GHz) or 0.8nm (100GHz) channel spacing. For use in applications up to 640km at 2.5Gbps or up to 80km at 10Gbps in standard single mode fiber.

The device design is a buried heterostructure quantum-well DFB laser with a monolithically integrated quantum-well EA modulator. The device is grown by MOCVD on the p side, and the n-side substrate is metalized for soldering on a chip carrier. Gold bonding pads for the DFB laser and EA modulator are provided on the p side. The output facet is anti-reflection coated and the rear facet has a high reflectance coating. The EML chips are delivered from certified, ultra-stable wafers that have met yield requirements for high-temperature and high-current purging and other CW and dynamic tests. Each shipped EML chip is CW tested at 25°C.

Applications:

- MC510 is designed for high-speed telecom (Sonet) or Datacom (Ethernet) Long-haul transmission or Metro systems.
- For use in applications up to 640km at 2.5Gbps or up to 80km at 10Gbps in standard single mode fiber.

Features:

- Low laser threshold current
- High reliability laser and EA modulator design optimized for up to 12.5Gbps
- Operating temperature: 20°C to 45°C
- Available for non-ITU (nominal 1550nm) or C-band DWDM channels from 1527nm to 1563nm
- 50GHz or 100GHz wavelength spacing.
- Superior performance compared to directly modulated DFB lasers
- Manufactured by high quality MOCVD epitaxy and high-reliability process
- Proven long-term reliability.

Compliance:

- Conforms to the requirements of the European Union Directive 2002/95/EC for the Restriction of Hazardous Substance (RoHS)

| EML Chip Characteristics ($T_c = 25^\circ\text{C}$, $NA = 0.45$) | | | | | | |
|---|-----------|---|---------|------|---------|------|
| PARAMETER | SYMBOL | CONDITION | MIN | TYP. | MAX | UNIT |
| Laser Threshold Current | I_{th} | CW | | 10 | 20 | mA |
| Front Power | P_f | $V_m=0$, $I_f = 70\text{mA}$ | 6 | 9 | | mW |
| Slope Efficiency | η | $V_m=0$, $I_f = 70\text{mA}$ | 0.10 | 0.15 | | W/A |
| Slope Efficiency Rear Facet | η_r | $V_m=0$, $I_f = 70\text{mA}$ | 0.008 | 0.02 | | W/A |
| Forward Voltage | V_f | $V_m=0$, $I_f = 70\text{mA}$ | 0 | 1.3 | 1.7 | V |
| Series Resistance | R | $V_m=0$, $I_f = 70\text{mA}$ | | 5 | 10 | Ohm |
| Reverse Current | I_{rev} | $V_f = 2\text{V}$ | | <0.1 | 1 | mA |
| Peak wavelength | λ | $V_m=0$, $I_f = 70\text{mA}$ | 1527.22 | | 1563.86 | nm |
| See Page 5. | | | | | | |
| Side Mode Suppression Ratio | SMSR | $V_m=0$, $I_f = 70\text{mA}$ | 30 | 40 | | dB |
| Extinction Ratio | E_r | $I_f = 70\text{mA}$, $V_m = 0$ to -2.5V | 8 | 10 | | dB |
| Breakdown Voltage | V_{bd} | $I_m = -1\text{mA}$ | | | -6 | V |
| Leakage Voltage | V_{lk} | $I_m = -0.05\text{mA}$ | | | -3 | V |

| Typical Chip-on-Carrier Characteristics ($T_c = 25^\circ\text{C}$, output coupled to single-mode fiber) | | | | | | |
|---|---------------|--|------|-------|-------|----------------------|
| PARAMETER | SYMBOL | CONDITION | MIN | TYP. | MAX | UNIT |
| DC Extinction Ratio | DC E_r | $I_f = 70\text{ mA}$, $V_m = 0$ to -2.5V | 15 | 18 | | dB |
| Modulation Bandwidth | BW | $I_f = 70\text{ mA}$, $V_m = -1\text{V}$, at -3dB | | 12 | | GHz |
| Peak-to-Peak Drive Voltage | V_{pp} | $E_r = 10\text{ dB}$ | | 2.5 | | V |
| Mark Offset Voltage | V_{mark} | $E_r = 10\text{ dB}$ | -1.0 | -0.5 | -0.01 | V |
| Rise Time | τ_r | $E_r = 10\text{dB}$, 20 to 80% unfiltered | | 25 | | Ps |
| Fall Time | τ_f | $E_r = 10\text{dB}$, 20 to 80% unfiltered | | 25 | | Ps |
| Wavelength/Temperature Coefficient | $d\lambda/dT$ | $T_c = 20 - 35^\circ\text{C}$ | | 0.09 | | nm/ $^\circ\text{C}$ |
| Wavelength/Current Coefficient | $d\lambda/dI$ | $V_m=0$, $I_f = 70\text{mA}$ | | 0.007 | | nm/mA |
| Relative Intensity Noise | RIN | $V_f = 2\text{V}$ | | -125 | | dB/Hz |
| Transmission Penalty Due to Dispersion | P_p | | | | 2 | dB |

- Table Notes:**
1. T_c is the chip temperature.
 2. I_f is the forward current applied to the DFB laser.
 3. V_m is the DC voltage applied to the modulator when the EML is not modulated.
 4. I_m is the DC current through the modulator when reverse biased.

Absolute Maximum Operating Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device.
Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

| PARAMETER | SYMBOL | CONDITION | MIN | MAX | UNIT |
|-----------------------------|-----------|-----------|-----|-----|------|
| Laser Diode Reverse Voltage | V_{RL} | CW | - | 2 | V |
| Laser Diode Forward Current | I_{FL} | CW | - | 150 | mA |
| Optical Output Power | P | CW | - | 35 | mW |
| Laser Chip Temperature | T_{LD} | | 15 | 45 | °C |
| Modulator Reverse Voltage | V_{MR} | | - | 5 | V |
| Modulator Forward Voltage | V_{MF} | | - | 1 | V |
| Storage Temperature Range | T_{stg} | | -40 | +85 | °C |
| Storage Relative Humidity | H_{stg} | | | 80 | % |

Ordering information:

| MC510 | X | X | XX | X |
|-------|--|---|---|--|
| | Data Rate: G= 2.5Gbps M= 10Gbps | Wavelength: C= Fixed λ , C channel. H= Fixed λ , H channel. Omitted for Non-ITU | ITU channel: XX=ITU xx channel Omitted for Non-ITU | Carrier Type: 0= Bare chip Z= Standard carrier. |

E.g. MC510MC33Z is a 10Gbps, 1550nm C band, ITU Channel 33 laser fitted with a standard carrier.
MC510G0 is a 2.5Gbps, 1550nm non-ITU, bare laser chip only.

ITU Grid Wavelengths, Frequencies, Channels and ordering codes

Note – actual ordering codes may change depending on the device configuration selected as per the table on page 3.

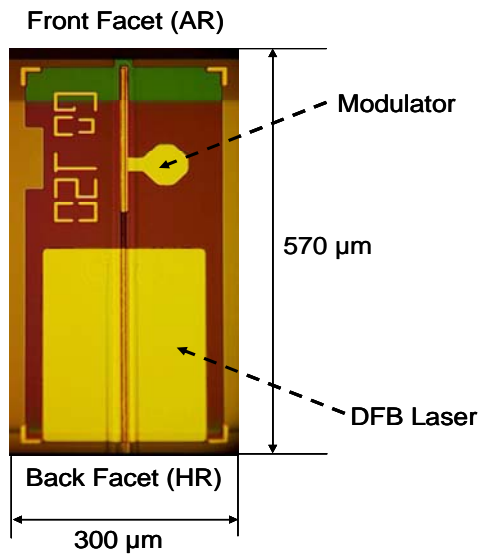
| Channel | Wavelength (nm) | Frequency (THz) | Code | Channel | Wavelength (nm) | Frequency (THz) | Code |
|---------|-----------------|-----------------|-----------|---------|-------------------|-----------------|-----------|
| H60 | 1529.16 | 196.05 | MC510H60Z | H37 | 1547.32 | 193.75 | MC510H37Z |
| C60 | 1529.55 | 196.00 | MC510C60Z | C37 | 1547.72 | 193.70 | MC510C37Z |
| H59 | 1529.94 | 195.95 | MC510H59Z | H36 | 1548.11 | 193.65 | MC510H36Z |
| C59 | 1530.33 | 195.90 | MC510C59Z | C36 | 1548.51 | 193.60 | MC510C36Z |
| H58 | 1530.72 | 195.85 | MC510H58Z | H35 | 1548.91 | 193.55 | MC510H35Z |
| C58 | 1531.12 | 195.80 | MC510C58Z | C35 | 1549.32 | 193.50 | MC510C35Z |
| H57 | 1531.51 | 195.75 | MC510H57Z | H34 | 1549.72 | 193.45 | MC510H34Z |
| C57 | 1531.90 | 195.70 | MC510C57Z | C34 | 1550.12 | 193.40 | MC510C34Z |
| H56 | 1532.29 | 195.65 | MC510H56Z | H33 | 1550.52 | 193.35 | MC510H33Z |
| C56 | 1532.68 | 195.60 | MC510C56Z | C33 | 1550.92 | 193.30 | MC510C33Z |
| H55 | 1533.07 | 195.55 | MC510H55Z | H32 | 1551.32 | 193.25 | MC510H32Z |
| C55 | 1533.47 | 195.50 | MC510C55Z | C32 | 1551.72 | 193.20 | MC510C32Z |
| H54 | 1533.86 | 195.45 | MC510H54Z | H31 | 1552.12 | 193.15 | MC510H31Z |
| C54 | 1534.25 | 195.40 | MC510C54Z | C31 | 1552.52 | 193.10 | MC510C31Z |
| H53 | 1534.64 | 195.35 | MC510H53Z | H30 | 1552.93 | 193.05 | MC510H30Z |
| C53 | 1535.04 | 195.30 | MC510C53Z | C30 | 1553.33 | 193.00 | MC510C30Z |
| H52 | 1535.43 | 195.25 | MC510H52Z | H29 | 1553.73 | 192.95 | MC510H29Z |
| C52 | 1535.82 | 195.20 | MC510C52Z | C29 | 1554.13 | 192.90 | MC510C29Z |
| H51 | 1536.22 | 195.15 | MC510H51Z | H28 | 1554.54 | 192.85 | MC510H28Z |
| C51 | 1536.61 | 195.10 | MC510C51Z | C28 | 1554.94 | 192.80 | MC510C28Z |
| H50 | 1537.00 | 195.05 | MC510H50Z | H27 | 1555.34 | 192.75 | MC510H27Z |
| C50 | 1537.40 | 195.00 | MC510C50Z | C27 | 1555.75 | 192.70 | MC510C27Z |
| H49 | 1537.79 | 194.95 | MC510H49Z | H26 | 1556.15 | 192.65 | MC510H26Z |
| C49 | 1538.19 | 194.90 | MC510C49Z | C26 | 1556.55 | 192.60 | MC510C26Z |
| H48 | 1538.58 | 194.85 | MC510H48Z | H25 | 1556.96 | 192.55 | MC510H25Z |
| C48 | 1538.98 | 194.80 | MC510C48Z | C25 | 1557.36 | 192.50 | MC510C25Z |
| H47 | 1539.37 | 194.75 | MC510H47Z | H24 | 1557.77 | 192.45 | MC510H24Z |
| C47 | 1539.77 | 194.70 | MC510C47Z | C24 | 1558.17 | 192.40 | MC510C24Z |
| H46 | 1540.16 | 194.65 | MC510H46Z | H23 | 1558.58 | 192.35 | MC510H23Z |
| C46 | 1440.56 | 194.60 | MC510C46Z | C23 | 1558.98 | 192.30 | MC510C23Z |
| H45 | 1540.95 | 194.55 | MC510H45Z | H22 | 1559.39 | 192.25 | MC510H22Z |
| C45 | 1541.35 | 194.50 | MC510C45Z | C22 | 1559.79 | 192.20 | MC510C22Z |
| H44 | 1541.75 | 194.45 | MC510H44Z | H21 | 1560.20 | 192.15 | MC510H21Z |
| C44 | 1542.14 | 194.40 | MC510C44Z | C21 | 1560.61 | 192.10 | MC510C21Z |
| H43 | 1542.54 | 194.35 | MC510H43Z | H20 | 1561.01 | 192.05 | MC510H20Z |
| C43 | 1542.94 | 194.30 | MC510C43Z | C20 | 1561.42 | 192.00 | MC510C20Z |
| H42 | 1543.33 | 194.25 | MC510H42Z | H19 | 1561.83 | 191.95 | MC510H19Z |
| C42 | 1543.73 | 194.20 | MC510C42Z | C19 | 1562.23 | 191.90 | MC510C19Z |
| H41 | 1544.13 | 194.15 | MC510H41Z | H18 | 1562.64 | 191.85 | MC510H18Z |
| C41 | 1544.53 | 194.10 | MC510C41Z | C18 | 1563.05 | 191.80 | MC510C18Z |
| H40 | 1544.92 | 194.05 | MC510H40Z | H17 | 1563.45 | 191.75 | MC510H17Z |
| C40 | 1545.32 | 194.00 | MC510C40Z | | | | |
| H39 | 1545.72 | 193.95 | MC510H39Z | | | | |
| C39 | 1546.12 | 193.90 | MC510C39Z | | | | |
| H38 | 1546.12 | 193.85 | MC510H38Z | Non-ITU | 1529.16 – 1563.45 | | MC510MZ |
| C38 | 1546.92 | 193.80 | MC510C38Z | | | | |

Chip / Chip-On-Carrier Handling Procedures

The following precautions should be observed when handling the chip or CoC.

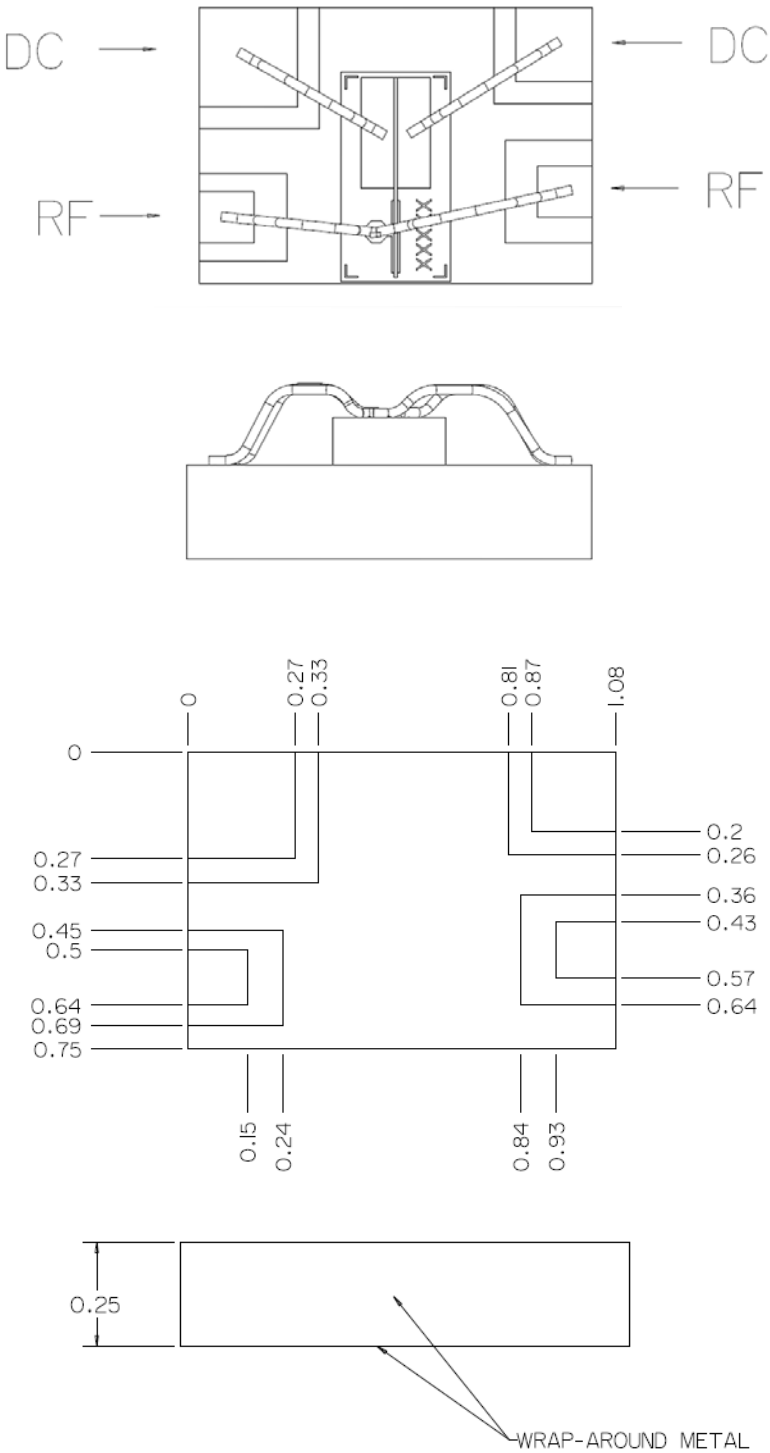
1. InP/InGaAsP chips are inherently fragile. Special cautions should be used when handling these devices.
2. A vacuum tip with flat surface is recommended. Metal tweezers should be avoided for handling chips.
3. Facets should not be touched.
4. These devices are static sensitive. Use appropriate ESD precautions when handling chips.

EML Chip Dimensions



- P-Side of die with chip ID
- Contact pads for laser and modulator
- N-side metalized for soldering chip on sub-mount
- Nominal die thickness 120 μm

EML Chip-On-Carrier Dimensions (in mm)



Electrostatic Discharge

The laser chip and chip-on-carrier are ESD-sensitive devices. Please insure that proper ESD handling procedures are followed.



Laser Safety

The laser chip or COS must be assembled into an appropriate package to provide electrical and optical interfaces. When this is done, the laser should meet the requirements of FDA 21CFR 1040.10 and 1040.11 as a Class 1 device.

Quality

Multiplex is qualified to International Standard ISO 9001:2008.

