Application Note: XCM Product Family High-Power 50W Module

Introduction

The XCM product family is a high-power Multi-Chip Module. It comes with two versions, one with attached fiber (XCM) and the other with detachable fiber (XCMDF). This high-power module can reach optical output power of 50W at 1470 nm. This application note is intended to describe how to operate XCM with a laser driver board, a temperature controller and a cold plate for thermal management and needed power supplies. Specifically, the XCMDF-101 package will be the point of reference for all specification and operational setup discussions.

Key Features and Benefits

The 50W optical output power of XCM requires an electrical power of 220W at a drive current of 10A and a voltage of 22V. Other key features include high heat load resilience, a detachable fiber, a photodiode, and thermistor. A red aiming can be added by request.

Applications

The XCM is the ideal choice for industry professionals who are looking for high-power devices with excellent performance in Medical, Aerospace, Defense, and Industrial applications.

Package Specifications

The XCMDF package is designed for high-power applications. The detachable fiber feature is optional, as well as the addition of a red aiming beam. The fiber option includes a 400 um fiber core, with a termination type SMA905. The package is designed with three (3) mounting through holes around the base, which are to be used with three (3) M3 screws. The XCM package has 6 or 9 pin outs, depending on the existence of a red aiming beam, respectively.

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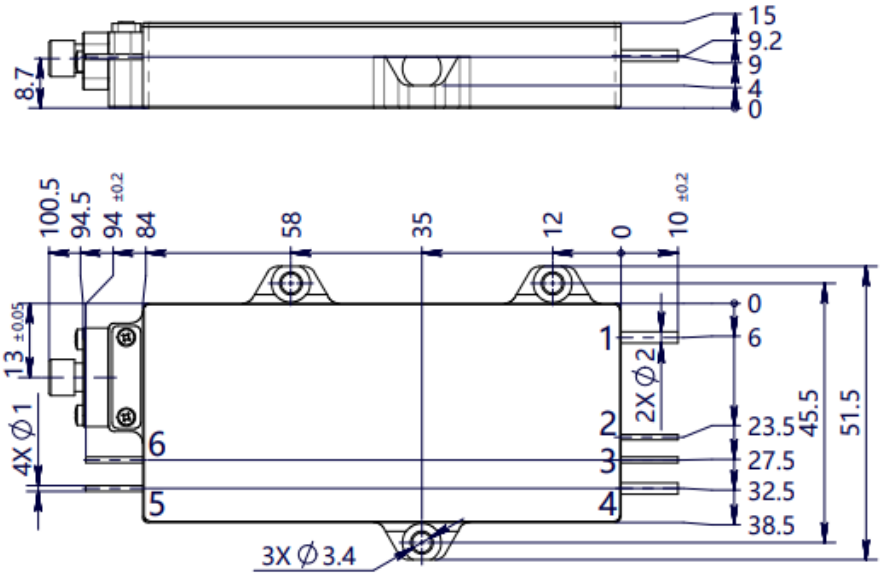
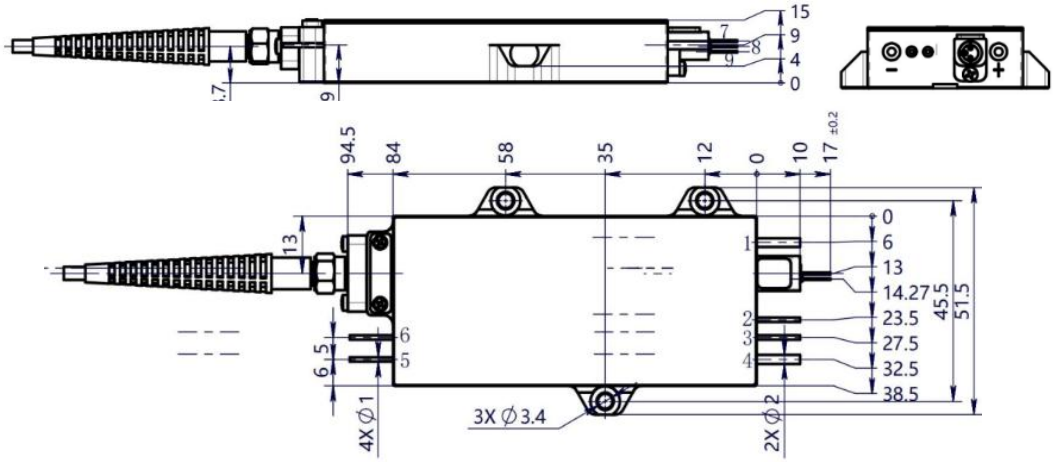


Pin	Function
1	LD (+)
2	Thermistor
3	Thermistor
4	LD (-)
5	PD (+)
6	PD (-)

Figure 1 (a). XCMDF package with detachable fiber option. Package specifications such as pinouts and options may change. Please contact SemiNex for your specific package and wiring configuration.



Pin	Function
1	LD (+)
2	Thermistor
3	Thermistor
4	LD (-)
5	PD (P)
6	PD (N)
7	Aiming (-)
8	-
9	Aiming (+)

Figure 1 (b). XCM package with fiber option. Package specifications such as pinouts and options may change. Please contact SemiNex for your specific package and wiring configuration.

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Table 1. Product Specifications

Electrical	Typ.	Units
Output Power (P_{out})	50	W (±10%)
Wavelength Range (λ_c)	1470	nm (±20)
Power Conversion Efficiency (η)	25	%
Mechanical		
Thermistor Constant	3477	β
Thermistor Resistance	10,000	Ohms
Module Dimensions*	84 (L) x 38.5 (W) x 15 (H)	mm
Environmental		
Operating Temperature Range	-20 to 60	°C
Storage Conditions	-40 to 80	°C

*Refer to Figures 1 (a) and (b) for more details.

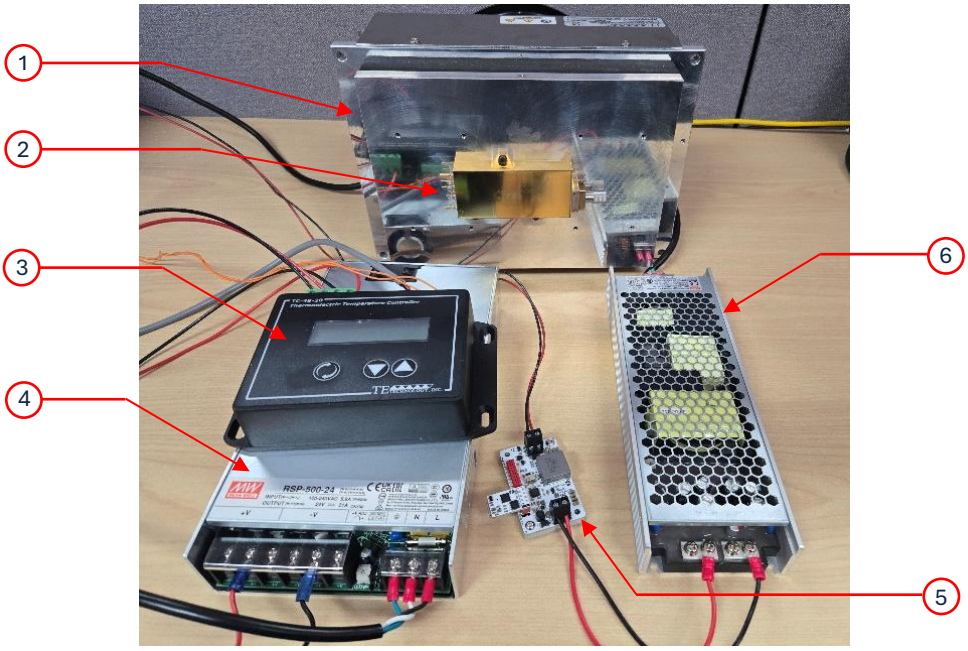

Figure 2. Key components for XCM operation: (1) Cold Plate (2) XCMDF Module (3) TEC Controller (4) TEC Power Supply (5) Laser Driver (6) Driver Power Supply

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Operation Setup

The XCMDF-101 was tested using a CW laser driver powered by a 36V supply, with thermal management provided by a cold plate set to 20°C and controlled by a TEC controller. The module achieved 53.8W at 10.6A and 19.5V, with a center wavelength of 1472nm and a spectral width of 8.4nm (3dB), demonstrating stable performance, with the option to switch to QCW if needed.

Required Equipment: *

- **CW/QCW Laser Driver**
- **Power Supply (for Driver)**
- **Cold Plate Cooler**
- **TEC Temperature Controller**
- **Power Supply (for TEC)**

* Contact SemiNex for equipment recommendations.

Operations

(1) Thermal management

a. Mounting XCM module on the cold plate:

For optimal operation, the package should be attached to a temperature controlled mounting plate, such as a cold plate or TEC. Attaching the laser package requires 3 M3 screws. The mounting plate should be tapped with hole patterns to match those in figure 1. For long term use and highly efficient thermal transfer between the package and cooling plate or TEC, a layer of thermal grease or indium foil should be used.

For short term operation (less than 1 minute), the use of thermal grease or indium can be avoided, but the temperature rise will be larger than with the grease or indium which will result in a decrease in optical power.

A. Attachment with Thermal Grease

Wipe the bottom of the package and top of the mounting plate with a clean cloth to remove any particles. Apply a small amount of grease to the bottom of the package. Spread the grease as evenly as possible using the roller or squeegee. Align the bolt holes of the package to the bolt holes in the mounting plate and secure with M3.5 screws. Tighten the screws as described above. Use caution to prevent over tightening. Do not exceed 5 in-pounds. Remove any excess grease using a towel.

For thermal management, a Cold Plate Cooler is recommended, rated at 200W of cooling capacity, to maintain the module within its optimal operating temperature range (25°C).

b. TEC control:

The cold plate is regulated by a TEC Temperature Controller, capable of handling 20A at 50V, providing precise temperature control. The TEC controller is powered by a dedicated 24V, 500W DC Power Supply. For operating this product, SemiNex recommends the base temperature be set to 20°C.

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Temperature Control Requirements

Cold Plate:

- Cooling Capacity: Cold plate with at least 200W of cooling power to manage heat dissipation.
- Temperature Stability: Maintain base temperature within ±0.1°C for consistent laser performance.

TEC Controller Specifications:

- Current Capacity: Supports up to 20A for high-demand thermal control.
- Voltage Range: Up to 50V to drive the TEC effectively.
- Precise Temperature Control: Adjustable setpoints with fine-tuning capability.
- Base Temperature Range: Ability to maintain typical operating temperatures around 20°C, with flexibility based on system needs.
- Thermal Protection: Over-temperature alarms and automatic shutdown to prevent overheating.
- Real-Time Monitoring: Continuous tracking of temperature, current, and voltage for safe operation.

(2) Electrical Operation

The laser module is powered using the CW/QCW Laser Driver, capable of delivering up to 15A at 40V, providing both continuous wave (CW) and quasi-continuous wave (QCW) operation modes. SemiNex recommends the laser driver be operated in CW mode, but the driver can be switched to QCW if needed. The driver is supplied by a 36V, 500W DC Power Supply.

Under these conditions, the XCMDF-101 maintained an output power of 53.8W at 10.6A and 19.5V. The center wavelength measured 1472nm with a spectral width of 8.4nm @ 3dB. An optical power meter was used to verify output power, while continuous temperature monitoring ensured the module remained within safe operating limits.

Laser Driver Requirements

The following list contains requirements for a laser driver being used to support XCMDF-101 operation setup:

- Current Capacity: Minimum of 15A continuous output.
- Voltage Range: Supports up to 40V.
- Operation Modes: Compatible with both CW (Continuous Wave) and QCW (Quasi-Continuous Wave) modes for application flexibility.
- Current Control: High-precision current regulation for stable optical output and device protection.
- Voltage Regulation: Stable voltage supply to prevent fluctuations that could impact performance.

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