Fast Diode Current Modulator VFM 1,5-25
Part Number 10100368
Operating Manual

English Edition

Description

The fast diode current modulator VFM 1,5-25 is a linear modulator with improved properties for driving arbitrary current waveforms into laser diodes in TO56 package.
Current waveforms can be CW, pulsed, modulated or mixed with frequencies up to 27 MHz and currents up to 1.5 A.
The VFM 1,5-25 is optimized for driving OSRAM's blue TB450 diode.

For achieving maximum performance it is required to mount the modulator as close as possible at the laser diode and to connect it with low inductance. Conventional wires for connecting are not allowed, this will decrease performance significantly and may lead to an unstable operating.

The VFM 1,5-25 is small and compact and it is designed for mounting it with low inductance as close as possible at the laser diodes or for integrating it in laser diode modules. Ask our support for more information and for important hints.

The modulator has two analogue inputs for the current setpoint, a high frequency input (50 Ohm input impedance) with a bandwidth of 27 MHz and a low frequency input with a bandwidth of 100 KHz. Both inputs cover the full current range.
Additionally there is a 10 turns potentiometer for generating a CW-current (bias current).
All set points are added and form the effective current set point.
A set point with a negative sign acts subtracting.

Furthermore the VFM 1,5-25 has a trigger input (TTL/CMOS) which acts at the high frequency input X2.
This trigger input controls the current set point 1 signal at X2.
A logic High-level at the trigger input puts through the current set point 1 signal to the VFM 1,5-25, a logic Low-level inhibits the current set point 1 signal.
In this way it is possible to generate fast and clean pulses by feeding in a DC voltage at the X2 input, even if the trigger signal has a bad waveform.

Power dissipation
Dynamic performance of the modulator normally increase with supply voltage, however the electrical power dissipation increase with supply voltage too.
A good compromise is to choose a supply voltage of approx. 5 V above the diode voltage.

Simple formulas for calculating power dissipation:

U_s	Supply Voltage (V)
U_d	Diode Voltage (V)
I_{dcw}	Diode Current CW (A)
I_{dpeak}	Diode Current peak value (A) (für sinusoidal and rectangle currents)
t_p	Pulse Duration (s)
f	Pulse Frequency (Hz)
P_l	Power Dissipation (W)

For operating with CW current:
$P_l = (U_s - U_d) \times I_{dcw}$

For operating with sinusoidal current:
$P_l = (U_s - U_d) \times (I_{dpeak} / 2)$

For operating with rectangle current:
$P_l = (U_s - U_d) \times I_{dpeak} \times t_p \times f$

For operating with sinusoidal current plus CW current:
$P_l = (U_s - U_d) \times ((I_{dpeak} / 2) + I_{dcw}))$

For operating with rectangle current plus CW current:
$P_l = (U_s - U_d) \times (I_{dpeak} \times t_p \times f + I_{dcw})$

Calculating power dissipation with arbitrary current waveforms is rather difficult, therefore a good method for estimating power dissipation is to measure the temperature of the modulator.
The modulator has a precise temperature measurement system inside. The SA-TEMP output reflects the actual temperature in the range of 0 °C … +80 °C.
Values of 60 °C (3 V) are still not critical.

General Instructions
Never run a negative current set point (effective current set point), this may lead to an overshoot if you alter the negativ current set point to a positive current set point.
If you use a pulse signal generator or a function generator for the current set point, always disconnect it before you change any ranges. Some generators create high voltage or undefined signals if you change ranges, this may damage diodes and the modulator.

If you are not sure what will happen, we recommend the following procedure for starting up:

Disconnect the diode and short-circuit the output of the modulator (connect X6- to X7+ via a short thin metal sheet).
Connect an oscilloscope at the X3 current monitor output, terminate the oscilloscope input with 50 Ohm.
Connect the supply voltage for the diode at X4- and X5+, take a power supply with an adjustable output voltage of approx. 0 V … 5 V. Adjust 5 V.
Connect the supply voltage (3 V … 6 V) for the internal electronics at X4- and X1-8.

Feed in a TTL-square wave or a CMOS-square wave with a pulse length of approx. 5 µs and a repetition rate of approx. 100 Hz at X1-7 (CD-TRIGG).
Feed in a positive DC-voltage of 500 mV (for an output current of 1.5 A) at X2 (CA-DCSP1).

Turn on the power supply for the internal electronics, the green LED must lit.
Turn on the power supply for the diode.

Enable the modulator and watch the X3 current monitor output.
The X3-signal must be a square wave with a pulse length of 5 µs, a repetition rate of 100 Hz and an amplitude of 82.5 mV.

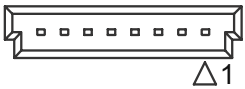
If the X3-signal is ok, disable the modulator and turn off the power supplies.
Connect the diode and adjust the supply voltage for the diode to a voltage of approx. 5 V above the diode voltage. Be aware of the maximum allowed power dissipation of the modulator.

Adjustment elements
10 turns potentiometer for a CW current set point (bias current)
The potentiomter covers the full current range.

Indicator elements
Green LED for indicating status Ready
Red LED for indicating status Excess Temperature

Connectors
X1, 8-pole single row male connector for control signals, status signals and supply voltage for the internal electronics
X2, female coaxial jack MMCX for current set point 1
X3, female coaxial jack MMCX for actual current (current monitor)
X4-, connection bolt ∅ 8 mm with female thread M4 for Supply Voltage Minus
X5+, connection bolt ∅ 8 mm with female thread M4 for Supply Voltage Plus
X6-, connection plate with six female thread M1.6 for laser diode cathode
X7+, connection plate with five female thread M1.6 for laser diode anode

X1 Control Port
8-pole single row male connector
Manufacturer: ERNI Part number 214014
Mating plug:
8-pole single row female connector
Manufacturer: ERNI Part number 224396



CA=Control Data Analog
CD=Control Data Digital
SA=Status Data Analog
SD=Status Data Digital

Inputs		
Pin	Name	Function
1	GND	Signal Ground
2	CA-DCSP2	Diode Current Set Point 2
3	CD-ENABLE	Enable
4	CD-RESET	Reset
7	CD-TRIGG	Trigger
8	SVI+	Supply voltage for the internal electronics
Outputs		
Pin	Name	Function
1	GND	Signal Ground
5	SA-TEMP	Temperature
6	SD-READY	Ready

X2 Control Port
Female coaxial jack MMCX
CA-DCSP1
Diode Current Set Point 1

X3 Current Monitor Port
Female coaxial jack MMCX
SA-DCACT
Diode Current Actual

X4-
Connection bolt ∅ 8 mm with female thread M4
Supply Voltage Minus for the laser diode

X5+
Connection bolt ∅ 8 mm with female thread M4
Supply Voltage Plus for the laser diode

X6-
Connection plate with six female thread M1.6
Laser Diode Cathode

X7+
Connection plate with five female thread M1.6
Laser Diode Anode

Signal description

SVI+
Supply voltage for the internal electronics
Required supply voltage: 3 V ... 6 V
Supply current: 1 A approx.
Plus must be connected at X1-8, Minus at X4-.

CA-DCSP1 (X2)
Control Analog - Diode Current Set Point 1
Analog input 0 … 500 mV, input impedance 50 Ohm
0 … 500 mV corresponds to a diode current of 1.5 A.

CA-DCSP2 (X1-2)
Control Analog - Diode Current Set Point 2
Analog input 0 … 5 V, input impedance 10 KOhm
0 … 5 V corresponds to a diode current of 1.5 A.

Diode Current Set Point 1, Diode Current Set Point 2 and the current value of the bias current potentiometer are added internally and build the effective current set point.
A current set point with negative sign acts subtracting.

SA-DCACT (X3)
Status Analog - Diode Current Actual
Analog output 0 … 165 mV (off-load voltage), output impedance 50 Ohm, reflects the actual diode current.
0 … 165 mV corresponds to a diode current of 0 ... 1.5 A.
For maximum performance the coaxial cable should be terminated with 50 Ohm.
In this case 0 … 82.5 mV corresponds to a diode current of 0 ... 1.5 A.

SA-TEMP (X1-5)
Status Analog - Temperature
Analog output 0 … 4 V, reflects the actual temperature of the modulator.
0 V corresponds to 0 °C, 4 V corresponds to +80 °C.

CD-ENABLE (X1-3)
Control Digital - Enabel
Digital TTL input, High if left open.
A Low-Signal or pulling the input to GND enables diode current.

CD-RESET (X1-4)
Control Digital - Reset
Digital TTL input, High if left open.
A Low-Signal or pulling the input to GND resets the modulator if there was an error (maximum allowed current exceeded or excessive temperature).

CD-TRIGG (X1-7)
Control Digital - Trigger
Digital TTL input, controls the current set point 1 signal at X2.
A logic High-level puts through the current set point 1 signal to the modulator,
a logic Low-level inhibits the current set point 1 signal.

SD-READY (X1-6)
Status Digital - Ready
Digital TTL output, High if there are no errors.

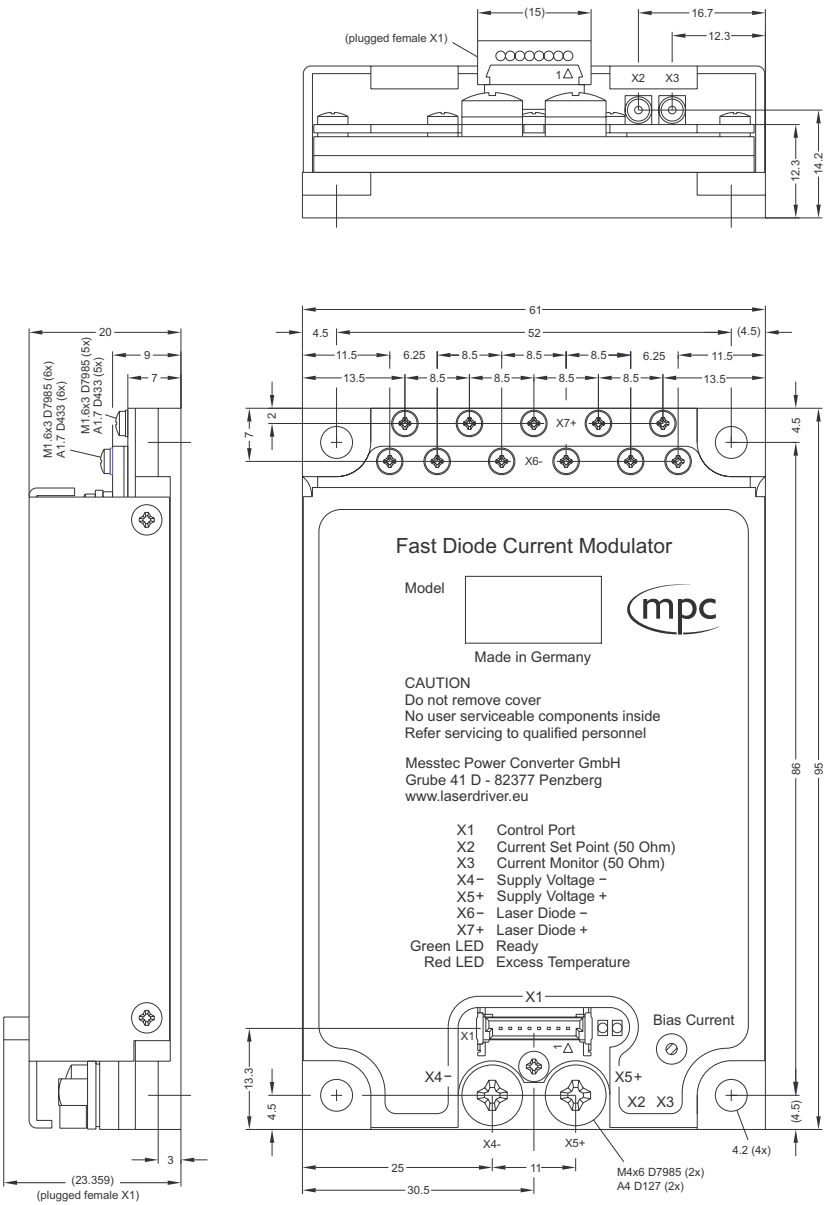
Specification

Supply voltage for the internal electronics	3 ... 6 V
Supply current	1 A approx.
Supply voltage	1 ... 25 V
Supply current	1.5 A max
Diode voltage	0 ... 24 V
Diode current CW	0 ... 1.5 A
Diode current pulsed	0 ... 1.5 A
Frequency bandwidth	DC ... 27 MHz (CA-DCSP1)
Frequency bandwidth	DC ... 100 KHz (CA-DCSP2)
Rise time	14 ns
Fall time	23 ns
Accuracy	± 0.2 %
Linearity	± 0.2 %
Temperature stability	± 100 ppm / °C
Accuracy of SA-DCACT output	± 2 %
Power dissipation	30 W max. allowed
Cooling	required
Operating temperature range	0 ... +45 °C
Dimensions	95 x 61 x 20 mm
Weight	250 g
Part Number	10100368

Scope of delivery:

Fast Diode Current Modulator	Part Number 10100368
8-pole single row female connector	Part Number 10883510
2 pcs screw M4x6 DIN 7985	Part Number 10701642
11 pcs screw M1.6x3 DIN 7985	Part Number 10701609
11 pcs washer A1.7 DIN 433	Part Number 10705300

Dimensions (in mm)



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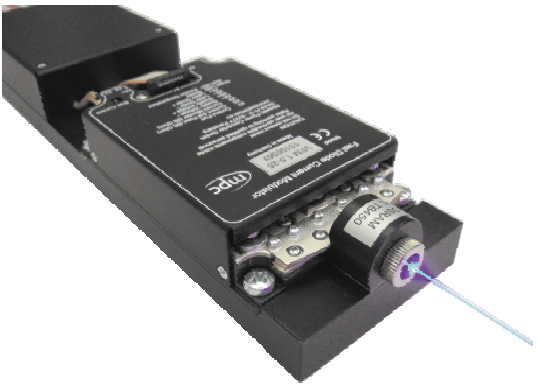

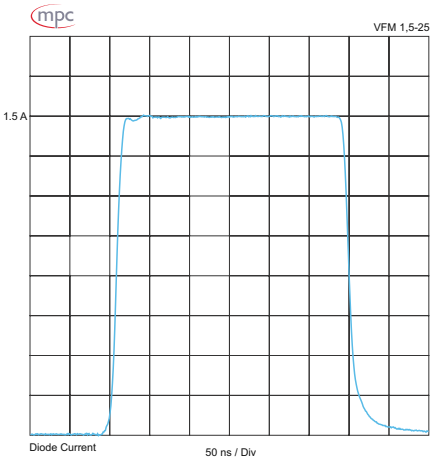

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