

# DATA SHEET

## Optical Dual Link DVI Module

### M1-2R2VI-DU

#### Contents

- ◆ Description
- ◆ Features
- ◆ Applications
- ◆ Technical Specifications
- ◆ Functions
- ◆ Drawing of Modules
- ◆ Drawing of Cable Connections
- ◆ DVI Pin Description
- ◆ Pin Description of DDC Connector
- ◆ Reliability Test

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# Optical Dual Link DVI Module

## - Fiber Detachable Connection System of Dual Link DVI -

### Description

The M1-2U2VI-DU DVI Module is a new member of the Opticis family of products that stretches your DVI/HDMI connectivity. Like M1-2R2-TR, a single link product, it offers an option of DDC connection over a copper cable with industrial secure connectors, which makes it easier to install.

The reality of high-speed digital graphic interconnections mandates products to maintain video quality and cost effectiveness of integrated display systems. Optical technology for gigabit digital transmission makes it simple to extend digital graphic data above the extension limits of copper wires providing pure signal integrity for an ideal visual experience, no EMI/RFI emissions, light weight, rugged cabling and connectors, low power consumption and installation ease.

The extension system consists of transmitter and receiver module boxes with male DVI-D (Digital Visual Interface) plugs, being able to connect PCs or Media Receivers and displays by DVI-D copper cables respectively. LC patch cords fiber-optic cable enables to transmit graphic data and UTP cable with RJ-45C enables to manage power and EDID/HDCP parameters up to 100m (330ft). Internally, Opticis' optical technology - the transmitter's 850nm VCSEL array and the receiver's Pin-PD array, are concealed within the connector housings.

The UTP cable with RJ-45C connectors for DDC, Hot\_Plug detect (HPD) and +5V power, which is popular as LAN cables, is so designed as to utilize easily. The products are certified to EMI Class A by for FCC or CE for industrial or commercial uses.

The shipping group is shown as follows;

- 1) One transmitter converting electrical to optical signals
- 2) One receiver converting optical to electrical signals
- 3) Dual link DVI copper cables: 2 X M1-DVCO-010 (1.0m)
- 4) AC power Adapter: M1-2D12PW
- 5) UTP cable for DDC (Option): M1-DDCRJ-xxx (RJ45-C Connector), where xxx stands for the cable length in meter up to 100m (165feet). The standard length is 20 meter (66feet).
- 6) Fiber-optic cable with 2 x duplex LC connectors (Option): M1-DVOF4-xxx. Where xxx stands for the cable length up to 500m.

## **Features**

- ◆ Extend digital graphic/video signals as follows;
  - DDC/HDCP interconnection over the UTP cable: 100m (330feet).
- ◆ Comply with FDA/CDRH and IEC 60825-1 Class 1 Laser Eye Safety.
- ◆ Be verified in Class A, the industry standard by FCC or CE.
- ◆ Support up to 2,560 x 1,600 resolutions at 60Hz refresh rate with 1 pixel/clock mode.
- ◆ Comply with DVI 1.0 standard and DDC connection supports DDC2B mode.
- ◆ Adopts only an external power supply, +12V to supply both modules over UTP cable.
- ◆ Not require S/W driver to install; just plug and play.
- ◆ Use 850nm multimode light sources and equivalent photo detectors, so recommend 4 Duplex LC patch cord multi mode GOF or breakout GOF.
- ◆ Adopt 4 Duplex LC receptacles on the side-face of modules (R, G, B, Clock, R1, G1, and B1).
- ◆ Certifications: FCC / CE, Class 1 Laser Eye Safety

## **Applications**

- ◆ Power Mac G5 with graphic cards supporting Dual Link DVI and 30" Cinema Display
- ◆ High-end displays for applications of Medical and graphic design expert

## Technical Specifications

### - General Specifications

	Parameter	Specifications
Components	Laser Diodes in Tx Module	850nm Multi-mode VCSEL (Vertical Cavity Surface Emitting Laser)
	Photo Diodes in Rx Module	GaAs PIN-PD
Electrical	Input and Output Signals	TMD5 Level (complying with DVI1.0)
	Data Transfer Rate (Graphic Data)	Max. 1.62Gbps
	Total Jitter at the end of Rx output	Max. 309 ps
	Skew inter-channels	Max. 6ns
Optical	Link Power Budget	Min 10.5dB
Connect	Optical Connector	4 Duplex LC connectors
	Electric Connector Type from Modules and to Displays	24 pin DVI-D plug
	DDC Electric Cables between Two Modules	RJ45-C
	Recommended Fiber	62.5/125 or 50/125 um Multi-mode Glass Fiber

### - Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Supply Adaptor Voltage	V <sub>CC</sub>	+ 10.0	+15.0	V
Operating Temperature	T <sub>op</sub>	0	50	°C
Operating Relative Humidity	RH <sub>op</sub>	10	85*	%RH
Storage Temperature	T <sub>sto</sub>	- 30	+ 70	°C
Storage Relative Humidity	RH <sub>sto</sub>	10	95*	%RH

Note\*: Under the condition of No drops of dew

### - Operating Conditions

#### Transmitter module

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Adaptor Voltage	AV <sub>CC</sub>	11.4	12	12.6	V
	Supply Voltage	V <sub>CC</sub>	4.5	5	5.5	V
	Supply Current	I <sub>TCC</sub>	-	300	350	mA
	Power Dissipation	P <sub>TX</sub>		3.6	4.41	W
	Power Supply Rejection (Note1)	PSR		50		mV <sub>p-p</sub>
TMD5	Data Output Load	R <sub>LD</sub>		50		Ω
	Graphic Supply Voltage (Note2)	GV <sub>CC</sub>	+ 3.1	+ 3.3	+ 3.5	V
	Single-Ended High Level Input Voltage	GV <sub>IH</sub>	GV <sub>CC</sub> - 0.01	GV <sub>CC</sub>	GV <sub>CC</sub> + 0.01	V
	Single-Ended Low Level Input Voltage	GV <sub>IL</sub>	GV <sub>CC</sub> - 0.6	-	GV <sub>CC</sub> - 0.4	V
	Single-Ended Input Swing Voltage	GV <sub>ISWING</sub>	0.4	-	0.6	V
Optical Link (Notes3)	Output Optical Power	P <sub>o</sub>	-9.5		-3.6	dBm
	Wavelength	λ	830	850	860	nm
	Spectral width in RMS	Δλ			0.85	nm
	Relative Intensity of Noise (Note4)	RIN		-117		dB/Hz
	Extinction Ratio	Ext	9			dB
	Rising/Falling Time	T <sub>rise</sub> /T <sub>fall</sub>			260	ps
	Jitter in p-p value (Note5)	T <sub>jitter</sub>			290	ps

Note1. Tested with a 50mV<sub>p-p</sub> sinusoidal signal in the frequency range from 500 Hz to 500 MHz on the V<sub>CC</sub> supply with the recommended power supply filter in place. Typically less than a 0.25 dB change in sensitivity is experienced.

- Note2. Graphic Supply Voltage is regulated reference voltage for signal processing in modules  
 Note3. Measure signals at the end of 2 meter 50/125um MMGOF  
 Note4. Measure in 1GHz of frequency bandwidth  
 Note5. Use PPG (Pulse Pattern Generator) source with jitter 50ps

### Receiver module

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Adaptor Voltage	AV <sub>CC</sub>	11.4	12	12.6	V
	Supply Voltage	V <sub>CC</sub>	4.5	5	5.5	V
	Supply Current	I <sub>RCC</sub>	-	400	450	mA
	Power Dissipation	P <sub>RX</sub>	-	4.8	5.67	W
	Power Supply Rejection (Note6)	PSR		50		mV <sub>p-p</sub>
TMDS	Data Input Load	R <sub>LD</sub>		50		Ω
	Graphic Supply Voltage (Note7)	GV <sub>CC</sub>	+ 3.1	+ 3.3	+ 3.5	V
	Single-Ended Output Swing Voltage (Note8)	GV <sub>ISWING</sub>	0.4	-	0.6	V
Optical Link (Note9)	Receiving Optical Power	P <sub>o</sub>	-20		-3.6	dBm
	Receiving Wavelength	λ	830	850	860	nm
	Signal_Detect Good	SDg			-17	dBm
	Signal_Detect Fail	SDf	-25			dBm
	Link Power Budget	P <sub>bgt</sub>	10.5			dB
	Total Jitter (note 10)	TR <sub>jitter</sub>			309	ps

- Note6. Tested with a 50mV<sub>p-p</sub> sinusoidal signal in the frequency range from 500 Hz to 500 MHz on the V<sub>CC</sub> supply with the recommended power supply filter in place. Typically less than a 0.25 dB change in sensitivity is experienced.  
 Note7. Graphic Supply Voltage is regulated reference voltage for signal processing in modules  
 Note8. TMDS outputs are coupled in AC  
 Note9. Measure signals at the end of 2 meter 50/125um MMGOF  
 Note10. It is measured as total jitters including Tx and Rx modules under maximum extension, 500 meters with UXGA 60Hz.

### - Recommended Specifications of Fiber-Optic Cables

Parameters	Conditions	Specifications
Fiber Type	Multimode Glass of Fiber	62.5/125 or 50/125μm
Modal Bandwidth	λ = 850nm	Min. 400 MHz km
Fiber Cable Attenuation	λ = 850nm	Max. 3.5dB/km
No. of Ferrules	4 pairs of duplex LC* or 8 simplex LCs	8 ferrules (one is N.C.)
Skew		Max. 0.4ns
Insertion Attenuation		Max. 0.5dB
Total Optical Attenuation	In 330 ft (100 meter) extension	Max. 1.5dB

Note\*: some plastic couplers to clamp two LC connectors could not fit in.

## Functions

### - Power Save Mode in Transmitter Module

The laser diodes work only when +5V voltage should be supplied into the 14-pin in DVI connectors, that is, detecting plugging the DVI plug to the PC. The voltage passing through a regulator from the +5V PC power or external power has LD drive circuit work.

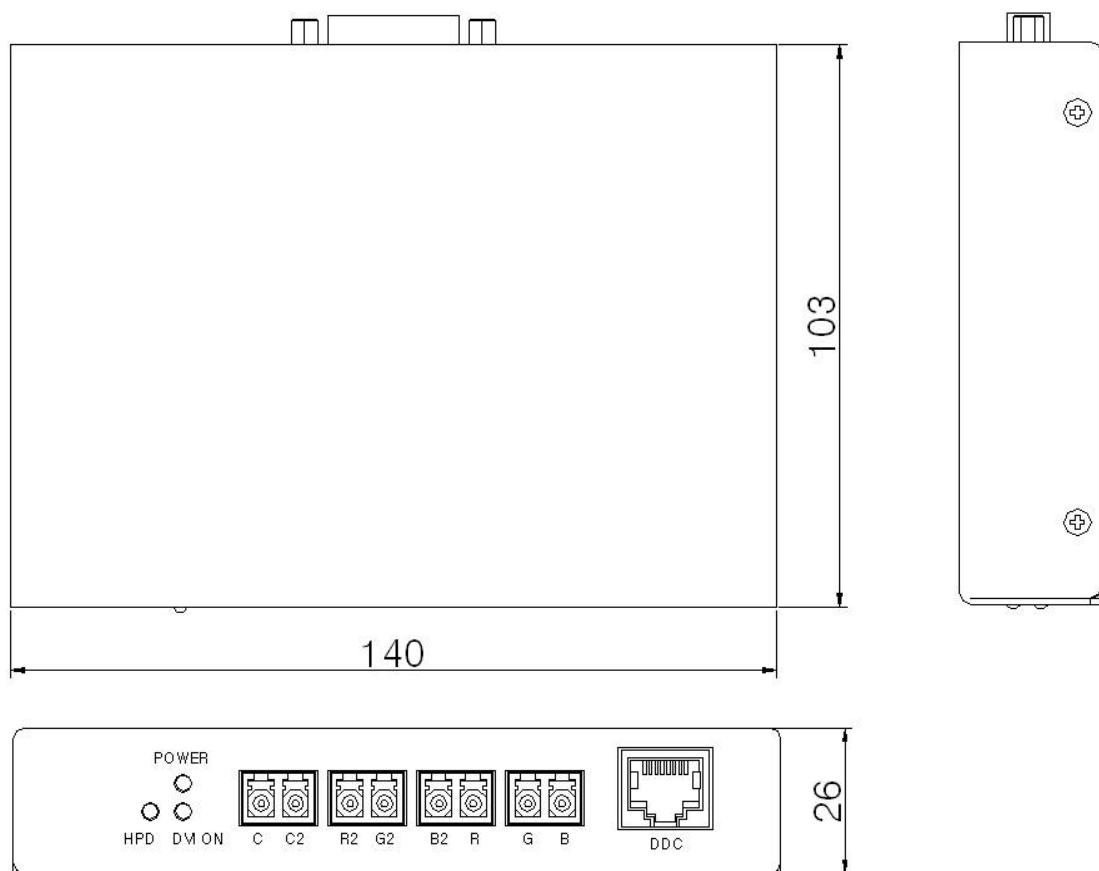
### - Signal Detect Mode in Receiver Module

It offers squelch function blocking output signals when optical input power is lower than as specified in a certain case, that is, detecting losing the LC fiber-optic patch cord.

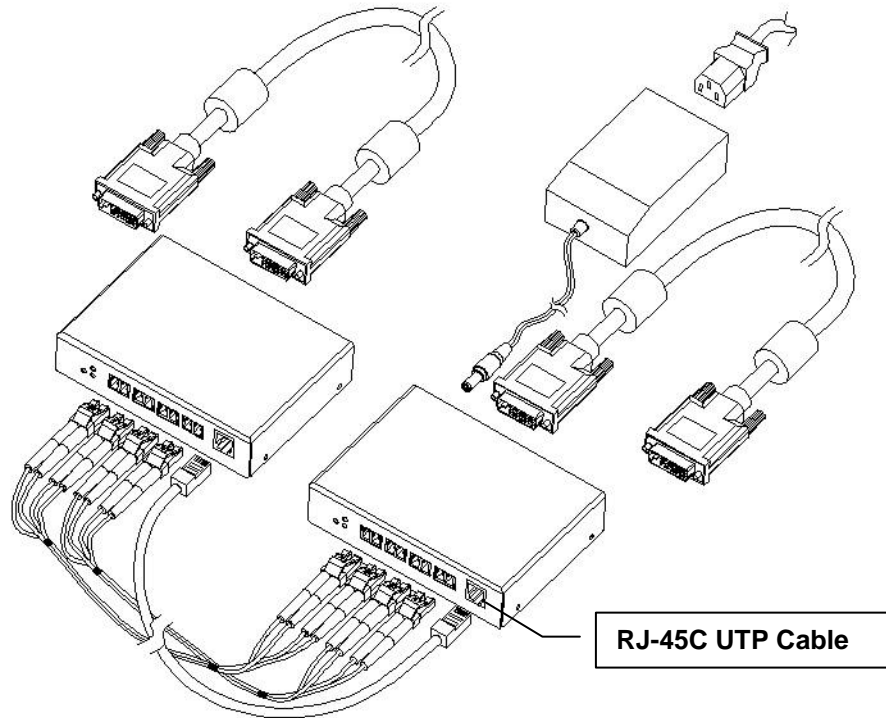
## Drawing of Modules

Dimension [mm]

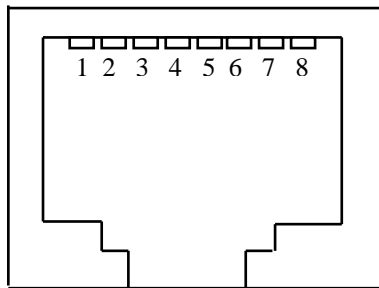
Note: The transmitter, M1-2xy-T and the receiver, M1-2xy-R have the same mechanical dimensions.



## Drawing of Cable Connections



## Pin Description for DDC Connector



Pin	Symbol	Functional Description
1	DDC Data GND	DDC Data line return ground
2	DDC Data	DDC Data line for DDC2B communication
3	DDC Clock GND	DDC Clock line return ground
4	Power GND	Main power return ground
5	Power	Main power for Opticis module
6	DDC Clock	DDC Clock line for DDC2B communication
7	5V_IN	DVI 5V (DVI No. 14 pin for Monitor)
8	HPD	Signal is driven by monitor to enable the system to identify the presence of a monitor

## DVI Pin Description

Pin	Symbol	Functional Description
1	CH2-	TMDS Data Signal Channel 2 Negative
2	CH2+	TMDS Data Signal Channel 2 Positive
3	GND	TMDS Data Signal Channel 2/4 Shield
4	CH4-	TMDS Data Signal Channel 4 Negative
5	CH4+	TMDS Data Signal Channel 4 Positive
6	DDC Clock	DDC Clock line for DDC2B communication
7	DDC Data	DDC Data line for DDC2B communication
8	N.C.	
9	CH1-	TMDS Data Signal Channel 1 Negative
10	CH1+	TMDS Data Signal Channel 1 Positive
11	GND	TMDS Data Signal Channel 1/3 Shield
12	CH3-	TMDS Data Signal Channel 3 Negative
13	CH3+	TMDS Data Signal Channel 3 Positive
14	5 V	5 V Input for Transmitter from Host
		5 V Output for Monitor from Receiver
15	GND	Ground
16	Hot plug Detect	Signal is driven by monitor to enable the system to identify the presence of a monitor
17	CH0-	TMDS Data Signal Channel 0 Negative
18	CH0+	TMDS Data Signal Channel 0 Positive
19	GND	TMDS Data Signal Channel 0/5 Shield
20	CH5-	TMDS Data Signal Channel 5 Negative
21	CH5+	TMDS Data Signal Channel 5 Positive
22	GND	TMDS Clock Signal Shield
23	CLK-	TMDS Clock Channel Negative
24	CLK+	TMDS Clock Channel Positive



## Reliability Test

We have three kinds of test criteria for a reduction of variability and a continuous improvement of the process by our FMEA (Failure Mode and Effective Analysis) program.

- 1) Mechanical test (Vibration, Shock)
- 2) Temp. & Humidity test
- 3) EMC test (FCC class A and CE Verification for M1-2R2-TR; FCC class B and CE Certification for M1-2S2-TR)

### Mechanical and Temp. & Humidity Test

Heading	Test	Conditions	Duration	Sample Size	Remarks
Operating Test	Operating at each Temperature (See Note)	0~50 °C (Interval: 10 °C)	30 Min (Each Temperature)	n=3	<b>Note:</b> Evaluate display quality of Laser Beam Projector connected to Graphic Signal Generator (Quantum Data: GD-802B) at each temperature. 1. T <sub>S</sub> : Storage Temperature 2. RH: Relative Humidity
Storage Test	Low Temperature	T <sub>S</sub> = -30 °C	96 HR	n=3	
	High Temperature	T <sub>S</sub> = 70 °C	96 HR	n=3	
	High Humidity / High Temperature	T <sub>S</sub> : 60 °C RH: 85%	96 HR	n=3	
Mechanical Test	Mechanical Shock	Pulse: 11 ms Peak level: 30 g Shock pulse: 6times/Axis	-	n=3	
	Mechanical Vibration	Peak acceleration: 5 g Frequency: 10~55 Hz Sweep time: 5 Minutes 2 Times/Axis	-	n=3	

**EMC Test**



**1) EMI: Meet FCC class A (ICES-003) and CE class A**

STANDARDS		CONDITIONS
EN 55 022 (CISPR22) <b>FCC; PART 15 SUBPART B</b>	CE (Conducted Emission) & RE (Radiated Emission)	Meet Class A
EN 61000-3-2 (IEC 61000-3-2)	Harmonics	Meet Class A
EN 61000-3-3 (IEC 61000-3-3)	Flickers	Meet Class A

**2) EMS: Meet CE standards (EN 55024) and CISPR24 equivalents**

STANDARDS		CONDITIONS
EN 61 000-4-2:1995	Electrostatic Discharge Immunity (Air: 8kv, Contact: 4kv)	Meet Criterion A or B
EN 61 000-4-3:1996	Radiated RF E-Field (80~1000 MHz) 3V/m (AM 80%, 1kHz)	Meet Criterion A or B
EN 61 000-4-4:1995	Fast Transients (5kHz, 60Seconds)	Meet Criterion A or B
EN 61 000-4-5:1995	Surge Transients	Meet Criterion A or B
EN 61 000-4-6:1996	Conducted Susceptibility (CS) Radiated Susceptibility (RS)	Meet Criterion A or B
EN 61 000-4-11:1994	Voltage Dips, Interruption & Variation	Meet Criterion A or B, and C