

# DATA SHEET

## Digital Video/Audio and Serial I/O

### Optical Extender

### M5-2A2

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## Digital Video/Audio and Serial I/O Extender

### Description

The reality of gigabit high-speed digital graphic interconnections mandates products that maintain front-of-screen video quality. Optical technology extends the ability to transmit digital graphic data beyond the physical limits of copper wires by, i) providing pure signal integrity over long distances for the optimum visual experience, ii) no EMI/RFI transmission or reception, iii) light weight, rugged cabling and connectors, iv) very cost effective per foot/metre, v) low power consumption, and vi) plug and go installation ease – no software requirements.

M5-2A2-TR offers integrated extension of digital video, audio and RS-232 interface up to 200m (656ft) for HDMI and up to 2km (6,560ft) for DVI. It maintains HD video signals up to WUXGA (1920x1200) at 60Hz refresh rate for PC and 1080p for HDTV. It is compatible with full DDC2B and HDCP. It supports connecting one of 3 different audio types in the transmitter; RCA, SPDIF (Optic) or SPDIF (Coaxial) and outputting all 3 audio types. RS232 serial interface offers device-to-device and device-to-controller connections to build up control system for A/V integration.

It is designed to multiplex and de-multiplex the DVI/HDMI video, digital/analog audio, Display Data Channel (DDC) command interface, High Definition Copy Protection (HDCP) and serial protocol so as to be linked over 4 LC fibers. It gives benefits of all-glass fiber transmission medium, data security, long distance extension up to 2km, easy plug-and-go installation and no RFI/EMI effects. In addition, a non-trivial feature is that both of Single and Multimode optical fibers are applicable.

The M5-2A2-TR consists of an Uplink (or transmitter; Tx) and a Downlink (or receiver; Rx), connected by two duplex LC terminated single or multi-mode patch cords between them, which offers electrical perfect isolation. Each link module is driven by +12V/3A DC power adaptor.

The shipping group is as follows;

- 1) One pair of the uplink and the downlink
- 2) Two +12V/3A power adaptors
- 3) User Manual

## Feature

- ◆ Extends DVI, Audio and RS232 with both single and multi-mode fibers.
  - up to 2km (6,560ft) over two (2) duplex LC single-mode fibers if using Smart DDC.
  - up to 500m (1,640ft) over two (2) duplex LC multi-mode fibers if using Smart DDC.
- ◆ Extends HDMI, Audio and RS232 up to 200 m with DDC/HDCP.
- ◆ Audio interface: Selectable RCA, SPDIF (Optic) or SPDIF (Coaxial).
- ◆ The electrical S/PDIF and Optical S/PDIF port can support only D-PCM or PCM audio format for stereo sound.
  - Ex) In case of Samsung (Bluray, SV-D507HD) DVD player
    - Audio Digital out: PCM
  - In case of Sony (DVP-NS92V, DVP-NS975V) DVD player
    - Audio Digital out: D-PCM
- ◆ Serial control data: RS232 with 9 pin D-sub female connector in the transmitter and male connector in the receiver.
- ◆ Video data: WUXGA (1920X1200), 24bit color and 60Hz refresh rate for DVI and 1080p for HDMI.
- ◆ Interconnection between transmitter and receiver: Two(2) Duplex LC patch cords of single or multi mode fiber.
- ◆ Applicable of both single and multi-mode fiber.
- ◆ +12 V DC power supply to each module.
- ◆ Complies with DDC2B/HDCP.
- ◆ No software to install; just plug and go.
- ◆ Data security with negligible RFI/EMI emissions
- ◆ Certifications: CE / FCC, Class 1 Laser Eye Safety

## Applications

- ◆ Digital display system integration for medical, military, aerospace, factory automation, and traffic control platforms.
- ◆ Digital FPD, PDP and projector installation in conference rooms, auditoriums and for kiosk systems
- ◆ LED signboards for large scale information display and stadiums

## Absolute Maximum Ratings

| Parameter                              | Symbol    | Minimum | Maximum | Units         |
|--|-----------|---------|---------|---------------|
| Storage Temperature                    | $T_{stg}$ | - 30    | + 70    | °C            |
| Supply Voltage                         | $V_{CC}$  | 10      | 16      | V             |
| Transmitter Differential Input Voltage | $V_d$     | -       | 1       | V             |
| Operating Humidity                     | RH        | 10      | 85      | %             |
| Lead Soldering Temperature & Time      | -         | -       |         | 260°C, 10 sec |

## Recommended Operating Conditions

| Parameter                      | Symbol   | Minimum | Typical | Maximum | Units             |
|--------------------------------|----------|---------|---------|---------|-------------------|
| Ambient Operating Temperature  | $T_A$    | 0       |         | + 50    | °C                |
| Data Output Load               | $R_{LD}$ |         | 50      |         | $\Omega$          |
| Power Supply Rejection (Note1) | PSR      |         | 50      |         | mV <sub>p-p</sub> |
| Supply Voltage                 | $V_{CC}$ | + 11.4  | + 12.0  | + 12.6  | V                 |

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

## Electrical Power Supply Characteristics

( $T_A = 0$  °C to +50 °C, unless otherwise noted)

| Parameter         | Symbol   | Minimum   | Typical | Maximum | Units |    |
|-------------------|----------|-----------|---------|---------|-------|----|
| Supply Voltage    | $V_{CC}$ | 11.4      | 12      | 12.6    | V     |    |
| Supply Current    | TX       | $I_{TCC}$ | 350     | 380     | 400   | mA |
|                   | RX       | $I_{RCC}$ | 370     | 390     | 420   | mA |
| Power Dissipation | TX       | $P_{TX}$  | 3.99    | 4.56    | 5.04  | W  |
|                   | RX       | $P_{RX}$  | 4.22    | 4.68    | 5.3   | W  |

**Optical & Electrical Characteristics**

(T<sub>op</sub> = 25°C)

| Parameters  |              | Symbol                           | Condition  | Unit            | Min.         | Typ.   | Max.         | Remark               |
|---|--------------|----------------------------------|--|-----------------|--------------|--|--------------|----------------------|
| Data Bit Rate   | 1310 Tx      |                                  | PRBS 2 <sup>23</sup> -1,NRZ  | Mbps            |              | 1250   |              |                      |
|   | 1550 Rx      |                                  |  |                 |              | 155.52   |              |                      |
|   | 1550 Tx      |                                  | PRBS 2 <sup>23</sup> -1,NRZ  | Mbps            |              | 155.52   |              |                      |
|   | 1310 Rx      |                                  |  |                 |              | 1250   |              |                      |
| Fiber Length<br>9µm core SMF  |              |                                  | 10 <sup>-10</sup> BER,<br>155Mbps/1.25Gbps                         | km              | 2            |  |              |                      |
| <b>TRANSMITTER</b>  |              |                                  |  |                 |              |  |              |                      |
| Average Power Output  |              | P <sub>OUT</sub>                 | I <sub>f</sub> =I <sub>BIAS</sub> + I <sub>mod</sub> /2            | dBm             | -11<br>-15   | -9<br>-10  | -7<br>-8     |                      |
| Extinction Ratio  |              | ER                               |  | dB              | 5            |  |              |                      |
| Center Wavelength   |              | c                                | CW, @ P <sub>OUT</sub>   | nm              | 1270<br>1500 | 1310<br>1550                                     | 1355<br>1600 | @1.31 µm<br>@1.55 µm |
| Spectral Width  |              |                                  | RMS Width  | nm              |              |  | 4.0          |                      |
| RIN   |              |                                  |  | dB/Hz           |              |  | -120         |                      |
| Optical Rise/Fall Time  |              | t <sub>r</sub> /t <sub>f</sub>   | 20 – 80%   | nsec            |              |  | 0.26<br>2.0  |                      |
| <b>RECEIVER</b>   |              |                                  |  |                 |              |  |              |                      |
| Sensitivity<br>(Average Input Power)  |              | P <sub>IN,MIN</sub>              | PRBS 2 <sup>23</sup> -1,<br>10 <sup>-10</sup> BER                  | dBm             |              |  | -23<br>-19   | 155M Rx<br>1.25G Rx  |
| Wavelength  | 1310<br>1550 |                                  |  | nm              | 1260<br>1500 | 1310<br>1550                                     | 1360<br>1600 |                      |
| Receiver Overload   |              | P <sub>IN,MAX</sub>              |  | dBm             | -3.0         |  |              |                      |
| Signal Detect Threshold<br>Decreasing light input<br>Increasing light input |              | P <sub>D</sub><br>P <sub>A</sub> |  | dBm<br>dBm      |              | P <sub>IN,MIN</sub> -3<br>P <sub>IN,MIN</sub> -2 |              |                      |
| Signal Detect Hysteresis  |              | P <sub>A</sub> - P <sub>D</sub>  |  | dB              | 0.5          |  |              |                      |
| Parameters  |              | Symbol                           | Condition  | Unit            | Min.         | Typ.   | Max.         | Remark               |
| <b>Audio (Analog)</b>   |              |                                  |  |                 |              |  |              |                      |
| Analog Sample Rate  |              | F <sub>audio_a</sub>             |  | kHz             |              | 48   |              |                      |
| Input level   |              | A <sub>in</sub>                  |  | V <sub>pp</sub> |              | 0.56V <sub>ss</sub>                              |              |                      |
| output level  |              | A <sub>out</sub>                 | V <sub>pp</sub> =3.3V/Analog                                       | V <sub>pp</sub> |              | 0.65   |              |                      |
| Input Impedance   |              |                                  |  | kΩ              |              | 25   |              |                      |
| Output Impedance  |              |                                  |  | Ω               |              | 100  |              |                      |
| <b>Audio (SPDIF)</b>  |              |                                  |  |                 |              |  |              |                      |
| Data Rate   | TX           |                                  | NRZ  | Mbps            | 0.1          |  | 6            |                      |
|   | RX           |                                  | NRZ  | Mbps            | DC           |  | 6            |                      |
| Pulse Width Distortion  |              | Δ tw                             | Pulse Width = 67ns<br>Pulse Cycle = 134ns<br>C <sub>L</sub> = 10pF | ns              | -15          |  | 15           |                      |
| Maximum Receivable Power  |              | P <sub>max</sub>                 | 15Mbps   | dBm             | -14.5        |  |              |                      |
| Minimum Receivable Power  |              | P <sub>min</sub>                 | 15Mbps   | dBm             |              |  | -24          |                      |
| Fiber Output Power  |              | P <sub>f</sub>                   |  | dBm             | -21          |  | -15          |                      |
| Center Emission Wavelength  |              | λ <sub>c</sub>                   |  | nm              |              | 650  |              |                      |



## 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 Shield  |
| 4   |                 |  |
| 5   |                 |  |
| 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 Shield  |
| 12  |                 |  |
| 13  |                 |  |
| 14  | 5 V             | 5 V Input for Transmitter from Host<br>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 Shield  |
| 20  |                 |  |
| 21  |                 |  |
| 22  | GND             | TMDS Clock Signal Shield   |
| 23  | CLK+            | TMDS Clock Channel Positive  |
| 24  | CLK-            | TMDS Clock Channel Negative  |

Note: Channels 3, 4 and 5 dual-link data signal pins are not used

## RS232C Pin Description

| Pin | Symbol                        | Functional Description                           |
|-----|-------------------------------|--|
| 1   | Received Line Signal Detector | Connected with Pin4 & Pin6 in module             |
| 2   | RD                            | Data Receive: Uplink $\leftrightarrow$ Downlink  |
| 3   | TD                            | Data Transmit: Uplink $\leftrightarrow$ Downlink |
| 4   | Data Terminal Ready           | Connected with Pin1 & Pin6 in module             |
| 5   | GND                           | Signal Ground                                    |
| 6   | Data Set Ready                | Connected with Pin1 & Pin4 in module             |
| 7   | Request To Send               | Connected with Pin8 in module                    |
| 8   | Clear To Send                 | Connected with Pin7 in module                    |
| 9   | NC                            |  |

Connection tips:

- 1) Connection of PC-to-PC: Cross connection of pins 2 and 3 between two PCs.
- 2) Connection of PC-to-Device: Straight connection of pin 2:2 and pin 3:3

## Reliability Test

Opticis utilizes three types of test criteria for a reduction of variability and a continuous improvement of the process by its FEMA (Failure Mode and Effective Analysis) program.

- 1) Mechanical test (vibration, shock)
- 2) Temperature & humidity tests
- 3) EMC test (*FCC class A and CE Verification*)

### Mechanical and Temperature & Humidity Test Data

| Heading                | Test                                      | Conditions   | Duration                     | Sample Size | Failure | Remarks                                 |
|------------------------|---|--|------------------------------|-------------|---------|---|
| <b>Operating Test</b>  | Operating at each Temperature (See Note)  | * 0 ~ 50 °C<br>(Interval: 10 °C)   | 30 Min<br>(Each Temperature) | n=3         | 0       | <b>Note:</b> Visual Test on the Display |
| <b>Storage Test</b>    | <b>Low Temperature</b>                    | * T <sub>s</sub> = -30 °C  | 96 HR                        | n=3         | 0       | 1. T <sub>s</sub> : Storage Temperature |
|                        | <b>High Temperature</b>                   | * T <sub>s</sub> = 70 °C   | 96 HR                        | n=3         | 0       | 2. RH: Relative Humidity                |
|                        | <b>High Humidity<br/>High Temperature</b> | * T <sub>s</sub> : 60 °C<br>* RH: 90%  | 96 HR                        | n=3         | 0       |   |
| <b>Mechanical Test</b> | <b>Mechanical Shock</b>                   | * Pulse: 11 ms<br>* Peak level: 30 g<br>* Shock pulse: 3 times/Axis                                | -                            | n=2         | 0       |   |
|                        | <b>Mechanical Vibration</b>               | * Peak acceleration: 20 g<br>* Frequency: 20~2000 Hz<br>* Sweep time: 30 Minutes<br>* 4 Times/Axis | -                            | n=2         | 0       |   |



**EMC Test Data**

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

| <b>STANDARDS</b>                              |   | <b>CONDITIONS</b> |
|---|---|-------------------|
| EN 55 022 (CISPR22)<br>FCC; PART 15 SUBPART B | CE (Conducted Emission) &<br>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**

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