

## Specification for approval

(DisplayPort Interface Controller for TFT-LCD Interface)

### Product Specification Status

- Preliminary
- Final

**Model: DCMR-62**



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### Customer

Approved by  
(Name / Title)

Signature

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*Please return one of these to us immediately with your signature for approval.*

*This specification is subject to legal disclaimers.*

## 1. Product Overview

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This DisplayPort to embedded DisplayPort converter board accepts standard DisplayPort 1.2 and all backward compatible signals. It generates all necessary control signals and panel data to drive TFT-LCDs. This TFT-controller board supports resolutions up to 1920x1200 (WUXGA) at a vertical refresh rate up to 60Hz. The user interface includes brightness, contrast adjustment, etc. by on-screen programming.

## 2. Features

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### General

16:9 or 16:9 to 4:3

- Support up to 1920x1200 (WUXGA) resolution @ 60Hz
- Supports eDP panel interfaces
- DDC/CI support by embedded DDC
- I<sup>2</sup>C-bus Interface

### Color Processor

- True 10-bit color processing engine
- sRGB compliance

### DisplayPort 1.2 Digital Input Interface

- High-Bandwidth Digital Content Protection (HDCP v1.4/2.2) support
- Three link layer speeds (HBR2 – 5.4GHz, HBR – 2.7GHz and RBR – 1.62GHz) are supported
- Support 6-bit, 8-bit, 10-bit, and 12-bit color depth transport

### VividColor™

- Independent color management (ICM)
- Dynamic contrast control (DCC)
- Image Adaptive Power Savings (IAPS)

### Auto Detection / Calibration

- Input format detection
- Compatibility with standard VESA Mode
- Smart engine for color calibration

### Output Interface

- Supports 8-bit output
- Supports 4 lane eDP HBR
- Supports 30 and 40 pin panel connections

### Scaling

- Fully programmable zoom ratios
- Independent horizontal/vertical scaling
- Advanced zoom algorithm provides high image quality
- Sharpness/Smooth filter enhancement
- Support non-linear scaling from 4:3 to

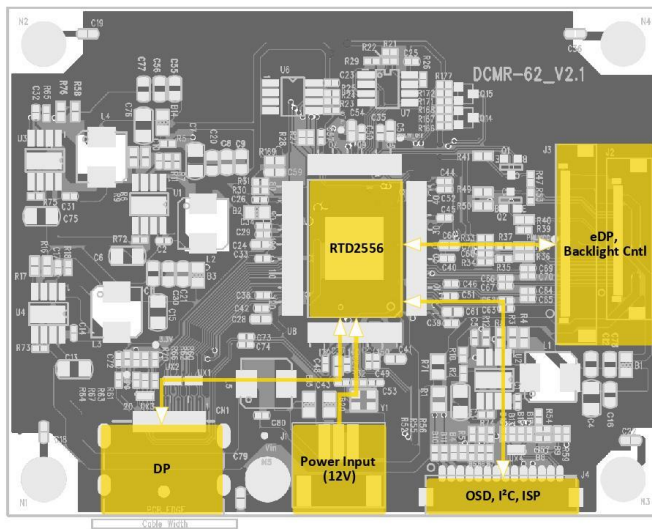
### On Screen Display menu

- Backlight dimming
- Color adjustment (contrast, brightness, etc.)
- Several other settings

### Environmental

- ✓RoHS
- ✓REACH

### 3. Functional Diagram



**Fig 1. System Diagram**

### 4. Typical Application



**Fig 2. Application of DCMR-62**

## 5. Electrical Characteristics

All ratings @  $V_{DD} = 12.0V$ ,  $\vartheta = 25^{\circ}C$  unless otherwise noted.

### 5.1. Input

**Table 1. Electrical Input Characteristics**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$V_{DD}$	Operating Supply Voltage	-	10.8	12.0	13.2	V DC
$V_{DDmax}$	Absolute Max. Rating <sup>1</sup>	-	-0.3	-	16	V DC
$I_{DD}$	Current Consumption <sup>2</sup>	Board Only (active mode)	-	95	-	mA
		Board Only (sleep mode)	-	10	-	mA
		With XGA Display <sup>3</sup>	0.23	0.45	0.67	A
		With FHD Display <sup>4</sup>	0.21	0.45	0.67	A
$P_C$	Power Consumption	-		1.14		W

### 5.2. Output

**Table 2. Electrical Output Characteristics**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$V_{Panel}$	Display Power Supply	3.3V configuration	3.0	3.3	3.6	V DC
		5V configuration	4.5	5	5.5	V DC
$V_{BKL}$	Backlight Power Supply	-	-	$V_{DD}$	-	V DC
$V_{BKL\_EN}$	Backlight Enable Voltage	-	3.0	3.3	3.6	V DC
$V_{BKL\_ADJ}$	Backlight Adjust Voltage	-	3.0	3.3	3.6	V DC

<sup>1</sup> Consider ratings of connected parts

<sup>2</sup> Current consumption depends on the firmware used (resolution)

<sup>3</sup> Test was performed with AUO G150XAB03.0 (XGA, 400cd/m<sup>2</sup>). Backlight PWM duty ratio min: 5%

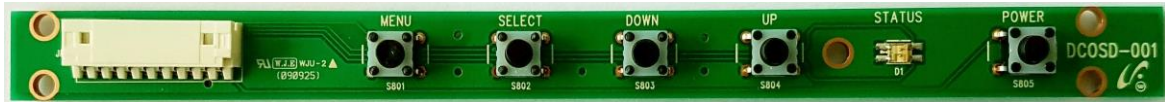
<sup>4</sup> Test was performed with BOE EV156FHM-N10 (FHD, 500cd/m<sup>2</sup>). Backlight PWM duty ratio min: 10%

## 6. OSD (On-Screen Display)

The user-friendly, intuitive controllable integrated OSD menu provides certain functions to change settings, adjust the image and others. It can be controlled by an OSD-keyboard. The status of the LCD controller can be checked by a LED which is integrated on the keyboard.

### 6.1.OSD-Keyboard

There are 5 buttons to control the OSD by the OSD-keyboard and one LED on it to show the board's status.



**Fig 3. OSD-keyboard**

#### Buttons

The function of each OSD key is shown in the following table.

**Table 3. OSD keyboard functions**

No.	Button	Switch Function	Hot-Key Function
1	Menu	1. Open OSD Main Menu 2. Save and leave setting	-
2	Select	Discard changes and exit	-
3	Down	1. Move left in menu list 2. Decrease the value of selected item	Show Signal Info
4	Up	1. Move right in menu list 2. Increase the value of selected item	-
5	Power	Turn power on / off	-

#### LED

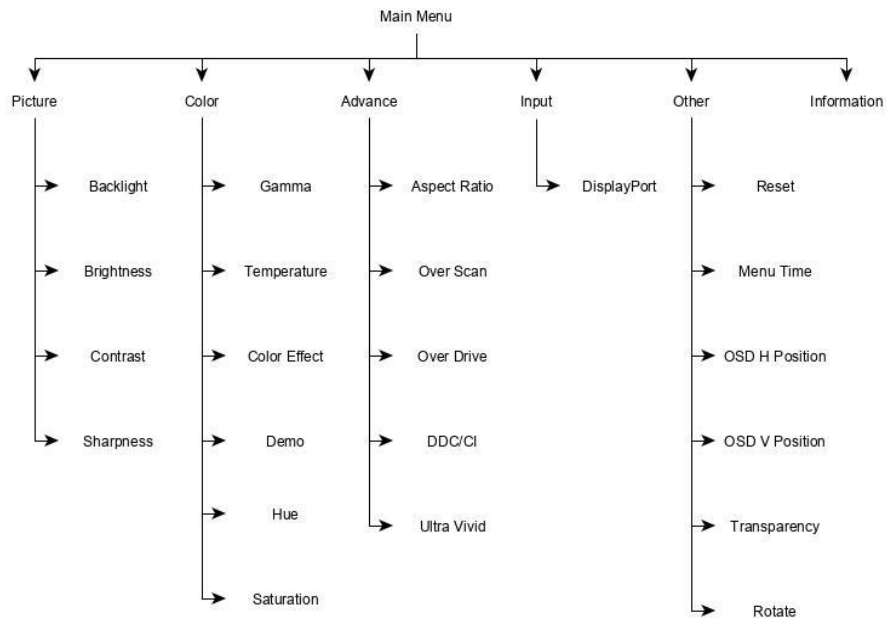
LED colors and their meanings are described in the table below.

**Table 4. OSD-keyboard LED status lights**

LED Color	Status	Meaning
Green	Constant	Normal state
Red	Constant	Searching signal

## 6.2.OSD-menu

### Menu Structure



### Menu Items

**Table 5. OSD Overview: Menu Items**

Title	Function
Picture	Adjust and optimize the image
Color	Adjust and optimize the color
Advance	Advanced settings
Input	Input source selection
Other	Adjust the On-Screen-Display settings
Information	Information about current timing

Main-Menu: Picture

**Table 6. OSD Overview: Main-Menu Picture**

Title	Function
Backlight	Adjust the backlight-intensity
Brightness	Adjust the brightness of the image
Contrast	Adjust the contrast of the image
Sharpness	Adjust the sharpness of the image

Main-Menu: Color

**Table 7. OSD Overview: Main-Menu Color**

Title	Function
Gamma	Adjust gamma level of the image
Temperature	Adjust the color temperature
Color Effect	Select a color effect
Demo	Select a mode to check hue and saturation settings
Hue	Adjust the color balance
Saturation	Adjust the color intensity

Sub-Menu: Temperature - User

**Table 8. OSD Overview: Sub-Menu: Temperature - User**

Title	Function
R	Adjust red video gain
G	Adjust green video gain
B	Adjust blue video gain

Sub-Menu: Color Effect - User

**Table 9. OSD Overview: Sub-Menu: Color Effect - User**

Title	Function
Color	Select 6-axis color
Hue	Adjust hue of respective color
Saturation	Adjust saturation of respective color

Main-Menu: Advance

**Table 10. OSD Overview: Main-Menu Advance**

Title	Function
Aspect Ratio	Select aspect ratio or scaling factor of the image
Over Scan	Enable / Disable overscan function
Over Drive	Enable / Disable overdrive function
DDC/CI	Enable / Disable DDC/CI function
Ultra Vivid	Select grades of Ultra Vivid color mode

Main-Menu: Input

**Table 11. OSD Overview: Main-Menu Input**

Title	Function
DisplayPort	n/a

Main-Menu: Other

**Table 12. OSD Overview: Main-Menu Other**

Title	Function
Reset	Reset all OSD settings to factory mode
Menu Time	Set the OSD duration [s]
OSD H Position	Set the horizontal position of OSD menu
OSD V Position	Set the vertical position of OSD menu
Transparency	Adjust the transparency of the OSD menu
Rotate	Rotate OSD by 0°, 90°, 180° or 270°

## Main-Menu: Information

**Table 13. OSD Overview: Main-Menu Information**

<b>Title</b>	<b>Function</b>
Signal Source	DisplayPort
Current resolution	1920x1080@60.0Hz
H-frequency	H: 67.5kHz
Pixel clock frequency	PCLK: 148.4MHz
HDCP function state	HDCP Disabled
Firmware name and –version	DCMR-62HB11 V1.4



## 7. Interfaces

### 7.1.eDP Interface

At the eDP-Interface, one to four main link lanes are supported. As the board is delivered pre-configured, no changes have to be made to the settings.

#### Settings

In order to achieve reliable communication when using longer cables, pre-emphasis may be applied to the eDP signal lanes. On the other hand, the spread spectrum function can enhance the behavior in an EMI sensitive environment.

For further information please contact Beck GmbH & Co. Elektronik Bauelemente KG.

### 7.2.I<sup>2</sup>C Interface

DCMR-62 has an integrated I<sup>2</sup>C-bus interface. By sending 8-bit commands it is possible to change several settings.

#### Operations

In general, the I<sup>2</sup>C-bus operations must follow the I<sup>2</sup>C-bus standard. For further information about I<sup>2</sup>C usage, please contact your local sales partner.

#### Write

A write operation looks the following way:

Start	Device Address	Write	Ack	Word Address	Ack	Data	Ack	Stop
-------	----------------	-------	-----	--------------	-----	------	-----	------

#### Read

A random read operation looks the following way:

Start	Device Address	Write	Ack	Word Address(n)	Ack	Start	Device Address	Read	Ack	Data(n)	No Ack	Stop
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### 7.3.DDC

This LCD controller provides a serial communications link between the video adapter and the controller, the DDC (Display Data Channel). Properties such as maximum resolution, color depth and supported video timing modes can be transmitted using DDC.

#### EDID

The DCMR-62 controller board supports the Extended Display Identification Data (EDID 1.4) standard.

EDID contains basic information about a monitor and its capabilities, including vendor information, maximum image size, color characteristics, factory pre-set timings, frequency range limits, a character's string for the monitor name and serial number. The video adapter uses this information for configuration purposes, so that the monitor and system can work together.

## DDC/CI

The display controller complies with the MCCS 2.2 standard. It supports a standard set of MCCS VCP codes to adjust the displayed image or control the display. Read and write commands are available for the following categories:

- Image Adjustments
- Color Adjustments
- Image Geometry Adjustments
- Audio Adjustments
- Window Operations
- DPVL Support

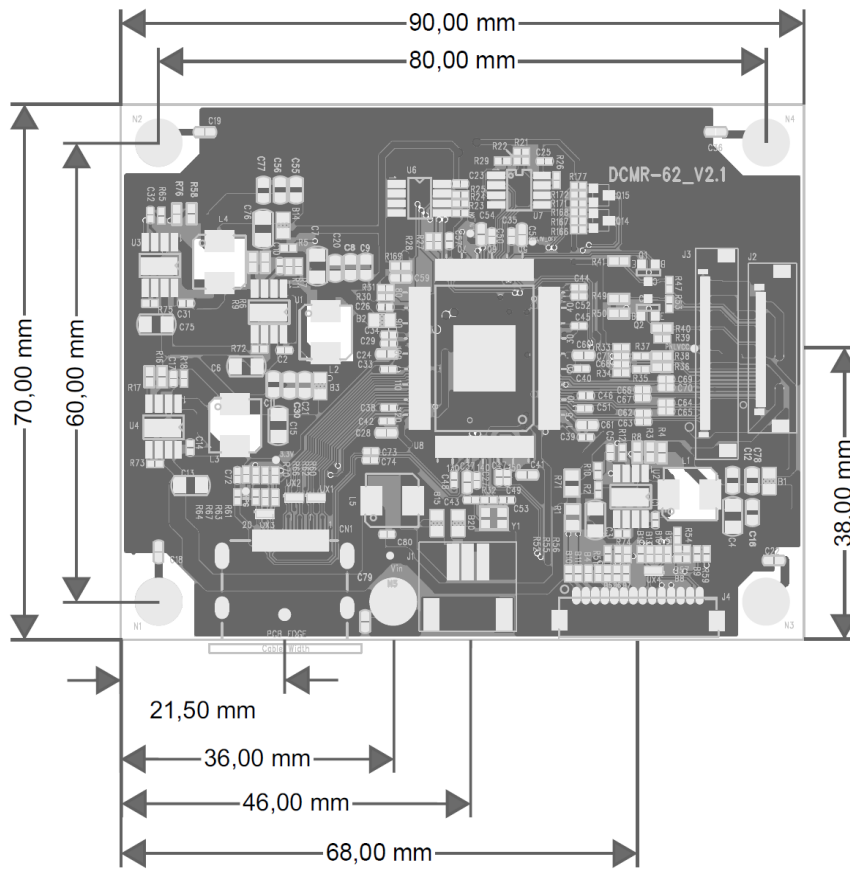
For detailed information about the supported MCCS VCP codes, please contact your local sales partner.

## 8. Mechanical Characteristics

**Table 14. Mechanical Characteristics**

Parameter	Value
Dimensions (H x V)	90mm x 70mm
Contour	Rectangular
Production technology	SMT & THT
Total height	9mm
Weight	26g

## 9. Drawing



**Fig 4. Product drawing**

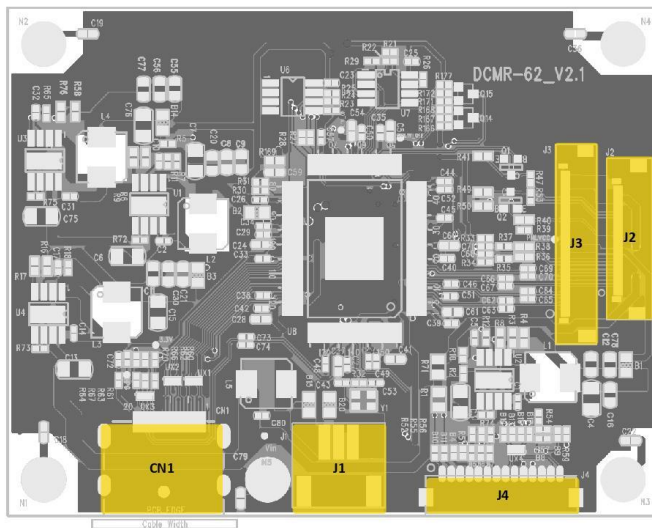
## 10. Connectors

Abbreviations used within this chapter are listed in the table below.

**Table 15. Signal Assignment Abbreviations**

Abbreviation	Description
GND	Ground
PWR	Power
I	Input
O	Output
I/O	Bi-directional

### 10.1. Connector Overview



**Fig 5. Connector Overview**

### 10.2. Input Connectors

#### Power Connector (J1)

The Power Connector (J1) supplies the board with power. The connection is mandatory.

**Table 16. Power Connector (J1)**

Parameter	Value
Manufacturer: Connector model no.	JST: S3B-PH-K-S
Pin amount	3 pins (use Pin 1 as marked on connector)
Mating housing part	JST: PHR-3





**Fig 6. JST: S3B-PH-K-S**

**Table 17. Power Connector Pin Assignment**

Pin	Signal	Description	Type
1	VIN	12V power input	PWR
2	GND	Ground	GND
3	GND	Ground	GND

DisplayPort Connector (CN1)

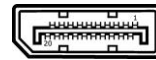
The DisplayPort Connector (CN1) delivers the video input-signal. The connection is mandatory.

**Table 18. DisplayPort Connector (CN1)**

Parameter	Value
Manufacturer: Connector model no.	Standard DisplayPort receptacle
Pin amount	20 pins (use Pin 1 as marked on connector)
Mating housing part	Standard DisplayPort plug



**Fig 7. DisplayPort Connector**



**Fig 8. DisplayPort Connector Pin Config.**

**Table 19. Pin description**

Pin	Signal	Description	Type
1	ML_Lane 0 (p)	Main-Link Lane 0+	I
2	GND	Ground	GND
3	ML_Lane 0 (n)	Main-Link Lane 0-	I
4	ML_Lane 1 (p)	Main-Link Lane 1+	I
5	GND	Ground	GND
6	ML_Lane 1 (n)	Main-Link Lane 1-	I
7	ML_Lane 2 (p)	Main-Link Lane 2+	I
8	GND	Ground	GND
9	ML_Lane 2 (n)	Main-Link Lane 2-	I
10	ML_Lane 3 (p)	Main-Link Lane 3+	I
11	GND	Ground	GND
12	ML_Lane 3 (n)	Main-Link Lane 3-	I
13	Config 1	-	-
14	Config 2	-	-
15	AUX CH (p)	AUX-CH+	I/O
16	GND	Ground	GND
17	AUX CH (n)	AUX-CH-	I/O
18	HPD	Hot-plug detect	O
19	PWR Return (GND)	Ground	GND
20	PWR (3,3V)	Power	PWR

### OSD, I<sup>2</sup>C, ISP Interface Connector (J4)

The OSD, I<sup>2</sup>C, ISP Interface Connector (J4) can be used for different purposes. An OSD-keyboard can be connected, the I<sup>2</sup>C-bus accessed or the board programmed by this interface. The connection is optional.

**Table 20. OSD, I<sup>2</sup>C, ISP Interface (J4)**

Parameter	Value
Manufacturer: Connector model no.	Molex: 53261-1471
Pin amount	14 pins (use Pin 1 as marked on connector)
Mating housing part	Molex: 51021-1400



**Fig 9. Molex: 53261-1471**

**Table 21. Pin description**

Pin	Signal	Description	Type
1	LED_GN	LED Green	O
2	LED_RD	LED Red	O
3	GND OSD/ISP	Ground	GND
4	Power Key	OSD Key Power	I
5	3.3V	Power	O
6	Menu Key	OSD Key Menu	I
7	Down Key	OSD Key Down	I
8	ISP DATA	ISP-I <sup>2</sup> C SDA	I/O
9	ISP CLK	ISP-I <sup>2</sup> C SCL	I/O
10	Up Key	OSD Key Up	I
11	Sel Key	OSD Key Select	I
12	n.c.	-	-
13	I <sup>2</sup> C SDA	EEPROM I <sup>2</sup> C SDA	I/O
14	I <sup>2</sup> C SCL	EEPROM I <sup>2</sup> C SDA	I/O

## 10.3. Output Connectors

### eDP Interface 30 Pin Connector (J2)

The eDP Interface 30 Pin Connector (J2) is one of two video output interfaces. The connection of one of these is mandatory.

**Table 22. eDP Interface 30 Pin Connector (J2)**

Parameter	Value
Manufacturer: Connector model no.	I-PEX: 20455-030E-02
Pin amount	30 pins (use Pin 1 as marked on connector)
Mating housing part	I-PEX: 20453-030T-02



**Fig 10. I-PEX: 20455-030E-02**

**Table 23. Pin description**

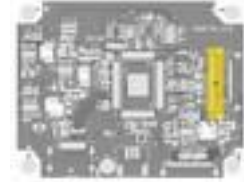
Pin	Signal Name	Description	Type
1	n.c.	-	n.c.
2	H_GND	High Speed Ground	GND
3	Lane1_N	Complement Signal Link Lane 1	O
4	Lane1_P	True Signal Link Lane 1	O
5	H_GND	High Speed Ground	GND
6	Lane0_N	Complement Signal Link Lane 0	O
7	Lane0_P	True Signal Link Lane 0	O
8	H_GND	High Speed Ground	GND
9	AUX_CH_P	True Signal Auxiliary Channel	I/O
10	AUX_CH_N	Complement Signal Auxiliary Channel	I/O
11	H_GND	High Speed Ground	GND
12	LCD_VCC	LCD logic and driver power	O
13	LCD_VCC	LCD logic and driver power	O
14	n.c.	-	n.c.
15	LCD_GND	LCD logic and driver ground	GND
16	LCD_GND	LCD logic and driver ground	GND
17	HPD	HPD signal pin	O
18	BL_GND	Backlight ground	GND
19	BL_GND	Backlight ground	GND
20	BL_GND	Backlight ground	GND
21	BL_GND	Backlight ground	GND
22	BL_ENABLE	Backlight On/Off	O
23	BL_PWM_DIM	System PWM signal input for dimming	O
24	n.c.	-	n.c.
25	n.c.	-	n.c.
26	BL_PWR	Backlight power	O
27	BL_PWR	Backlight power	O
28	BL_PWR	Backlight power	O
29	BL_PWR	Backlight power	O
30	n.c.	-	n.c.

### eDP Interface 40 Pin Connector (J3)

The eDP Interface 40 Pin Connector (J3) is one of two video output interfaces. The connection of one of these is mandatory.

**Table 24. eDP Interface 40 Pin Connector (J2)**

Parameter	Value
Manufacturer: Connector model no.	I-PEX: 20455-040E-02
Pin amount	40 pins (use Pin 1 as marked on connector)
Mating housing part	I-PEX: 20453-040T-02



**Fig 11. I-PEX: 20455-040E-02**



**Table 25. Pin description**

Pin	Signal Name	Description	Type
1	n.c.	-	n.c.
2	H_GND	High Speed Ground	GND
3	Lane3_N	Complement Signal Link Lane 3	O
4	Lane3_P	True Signal Link Lane 3	O
5	H_GND	High Speed Ground	GND
6	Lane2_N	Complement Signal Link Lane 2	O
7	Lane2_P	True Signal Link Lane 2	O
8	H_GND	High Speed Ground	GND
9	Lane1_N	Complement Signal Link Lane 1	O
10	Lane1_P	True Signal Link Lane 1	O
11	H_GND	High Speed Ground	GND
12	Lane0_N	Complement Signal Link Lane 0	O
13	Lane0_P	True Signal Link Lane 0	O
14	H_GND	High Speed Ground	GND
15	AUX_CH_P	True Signal Auxiliary Channel	I/O
16	AUX_CH_N	Complement Signal Auxiliary Channel	I/O
17	H_GND	High Speed Ground	GND
18	LCD_VCC	LCD logic and driver power	O
19	LCD_VCC	LCD logic and driver power	O
20	LCD_VCC	LCD logic and driver power	O
21	LCD_VCC	LCD logic and driver power	O
22	n.c.	-	n.c.
23	LCD_GND	LCD logic and driver ground	GND
24	LCD_GND	LCD logic and driver ground	GND
25	LCD_GND	LCD logic and driver ground	GND
26	LCD_GND	LCD logic and driver ground	GND
27	HPD	HPD signal pin	O
28	BL_GND	Backlight ground	GND
29	BL_GND	Backlight ground	GND
30	BL_GND	Backlight ground	GND
31	BL_GND	Backlight ground	GND
32	BL_ENABLE	Backlight On/Off	O
33	BL_PWM_DIM	System PWM signal input for dimming	O
34	n.c.	-	n.c.
35	n.c.	-	n.c.
36	BL_PWR	Backlight power	O
37	BL_PWR	Backlight power	O
38	BL_PWR	Backlight power	O
39	BL_PWR	Backlight power	O
40	n.c.	-	n.c.

## 11. Reliability

**Table 26. Reliability test**

Symbol	Test item	Min	Max	Unit
$\vartheta_{ST}$	Storage temperature	-10	70	°C
$\vartheta_{OP}$	Operating temperature	0	60	°C

## 12. Absolute Maximum Ratings

**Table 27. Absolute maximum ratings**

Symbol	Test item	Min	Max	Unit
$\vartheta_{ST}$	Storage temperature	-15	75	°C
$\vartheta_{OP}$	Operating temperature	-5	65	°C

## 13. Application Information

### 13.1. Operating Precautions

- Be sure to ground yourself before handling the controller board.
- Turn off power supply before inserting or disconnecting any connector.
- Spike noise causes misoperation of circuits. It should be lower than following voltage:  $\pm 200\text{mV}$  (over and under shoot voltage).
- This module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

### 13.2. General Cautions

- The responsibility for the applicability of customer specific products and use in a particular customer design is always within the authority of the customer.
- An important factor for each system integration is the thermal design. System designers might need to implement a passive or active cooling system in their specific design to keep the temperatures of all parts within the specification.
- Be careful about condensation at sudden temperature change. Condensation damages electrical contacted parts.
- When preparing a cable for a specific display, always refer to appropriate cable pin-out and display specification. Always check the signals before connecting the cable. Any incorrect pin connection may damage the display and the controller permanently.
- Take care of all the sensitive electronic components
- Do not modify the module assembly

- You must mount a module using its respective mounting holes and avoid any bend force during mounting.
- Be sure to do a reset in OSD if any problem occurs during operation
- Should you need any technical help, please contact Beck GmbH & Co. Elektronik Bauelemente KG

## 14. Packing / Labels

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Serial number looks in general the following way:

**ABCN.NN-YYMMDDXXXX**

**Table 28. S/N Encoding**

<b>Code</b>	<b>Meaning</b>
ABC	Acronym for the SMT producer
N.NN	Firmware version VN.NN
YYMMDD	Manufacturing date (YY/MM/DD)
XXXX	Manufacturing sequence of product

## 15. Abbreviations

**Table 29. Abbreviations**

<b>Abbr.</b>	<b>Description</b>
<b>BLU</b>	Backlight Unit
<b>BPC</b>	Bits Per Color
<b>BPP</b>	Bits Per Pixel
<b>DDC</b>	Display Data Channel
<b>DDC/CI</b>	Display Data Channel Command Interface
<b>DP</b>	DisplayPort
<b>DPMS</b>	Display Power Management Service
<b>EDID</b>	Extended Display Identification Data
<b>eDP</b>	Embedded DisplayPort™
<b>EEPROM</b>	Electrically Erasable Programmable Read-Only Memory
<b>EMI</b>	Electromagnetic Interference
<b>GND</b>	Ground
<b>HBR</b>	High Bit Rate
<b>HDCP</b>	High Digital Content Protection
<b>I<sup>2</sup>C</b>	Inter Integrated Circuit
<b>ISP</b>	In System Programming
<b>LCD</b>	Liquid Crystal Display
<b>LED</b>	Light Emitting Diode
<b>MCCS</b>	Monitor Command Control Set
<b>OSD</b>	On Screen Display
<b>PCB</b>	Printed Circuit Board
<b>PCLK</b>	Pixel Clock
<b>PWM</b>	Pulse Width Modulation
<b>REACH</b>	Registration, Evaluation, Authorization and Restriction of Chemicals
<b>RoHS</b>	Restriction of Hazardous Substances
<b>SMT</b>	Surface Mounted Technology
<b>TFT</b>	Thin-Film Transistor
<b>THT</b>	Through Hole Technology
<b>VCP</b>	Virtual Control Panel
<b>VESA</b>	Video Electronics Standards Association

## 16. Revision History

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**Table 30. Revision History**

Rev.	Date	Section	Specification Status	Description
0.1	Feb 15, 2019	All	Preliminary	Initial release
0.2	Sep 30, 2019	All	Preliminary	Changed product picture; Updated OSD structure

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## 17. Legal Information

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### 17.1. Disclaimers

#### Limited warranty and liability

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Applications that are described herein for are for illustrative purposes only. Beck GmbH & Co. Elektronik Bauelemente KG makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

The customer is responsible for the design and operation of his application. It is the customer's responsibility to determine whether this product is suitable for his applications and products.

#### Limiting values

Stress above one or more limiting values (as defined in section Absolute maximum ratings) may cause permanent damage and irreversibly affect the quality and reliability of the device.

### 17.2. Trademarks

All referenced brands, product names, service names and trademarks are the property of their respective owners.

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## Contact Information

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