

Specification for approval

(DisplayPort Interface Controller for TFT-LCD Interface)

Product Specification Status

- Preliminary
- Final

Model: DCMR-62



Customer

Approved by
(Name / Title)

Signature

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

This specification is subject to legal disclaimers.

1. Product Overview

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

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
- I²C-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

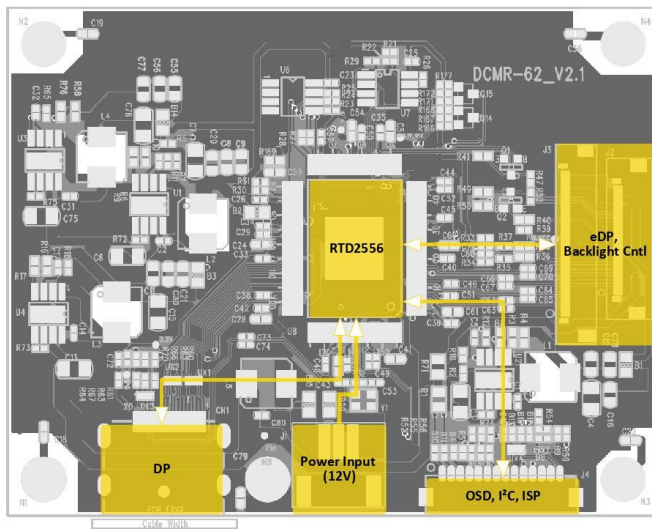


Fig 1. System Diagram

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 ¹	-	-0.3	-	16	V DC
I_{DD}	Current Consumption ²	Board Only (active mode)	-	95	-	mA
		Board Only (sleep mode)	-	10	-	mA
		With XGA Display ³	0.23	0.45	0.67	A
		With FHD Display ⁴	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

¹ Consider ratings of connected parts

² Current consumption depends on the firmware used (resolution)

³ Test was performed with AUO G150XAB03.0 (XGA, 400cd/m²). Backlight PWM duty ratio min: 5%

⁴ Test was performed with BOE EV156FHM-N10 (FHD, 500cd/m²). 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

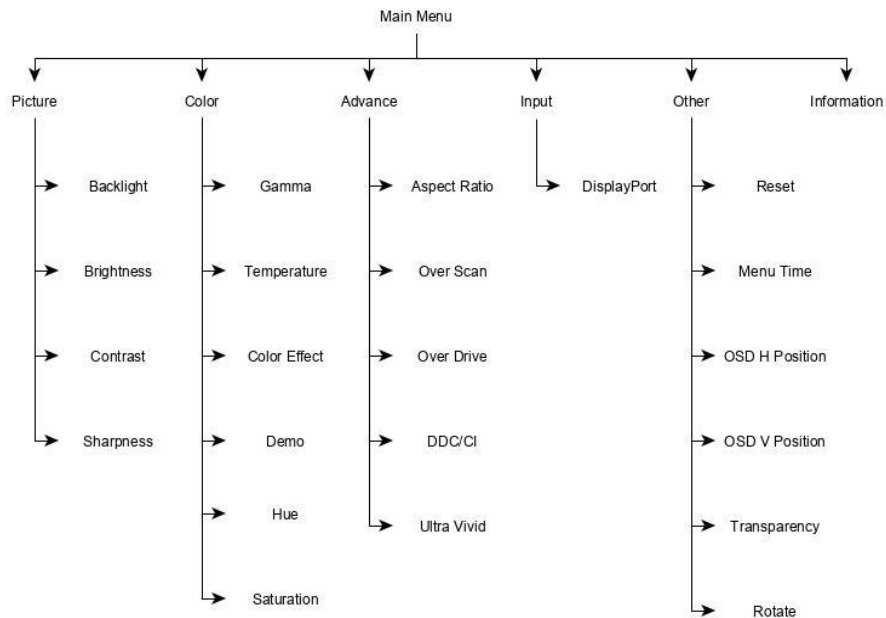
LED colors and their meanings are described in the table below.

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

Title	Function
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.I²C Interface

DCMR-62 has an integrated I²C-bus interface. By sending 8-bit commands it is possible to change several settings.

Operations

In general, the I²C-bus operations must follow the I²C-bus standard. For further information about I²C 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
-------	----------------	-------	-----	-----------------	-----	-------	----------------	------	-----	---------	--------	------

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

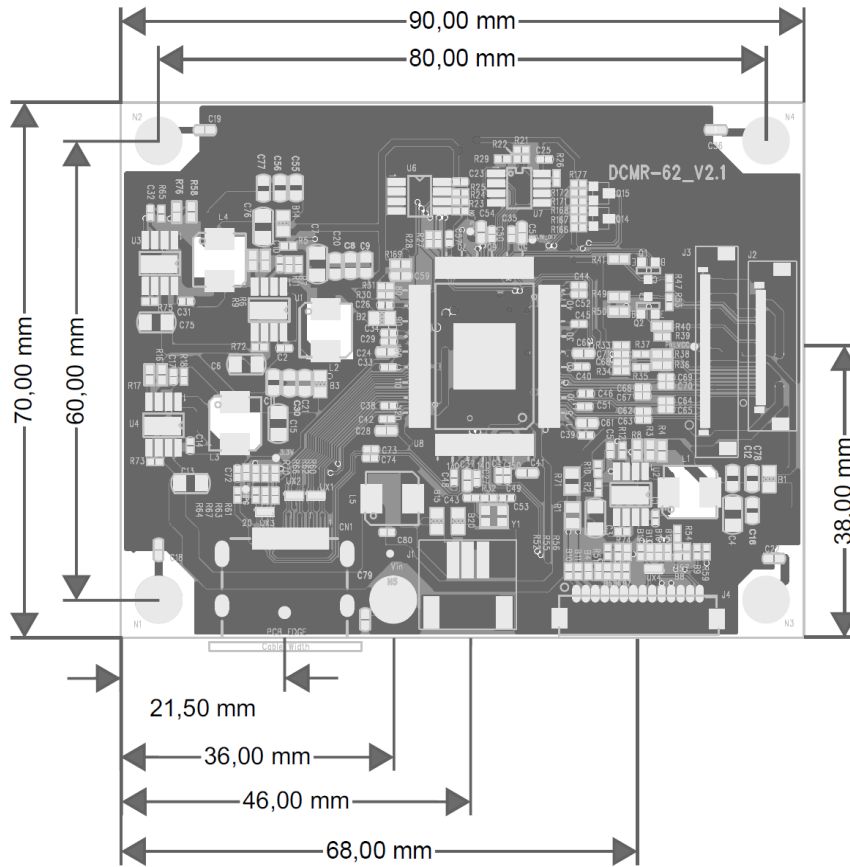


Fig 4. Product drawing

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

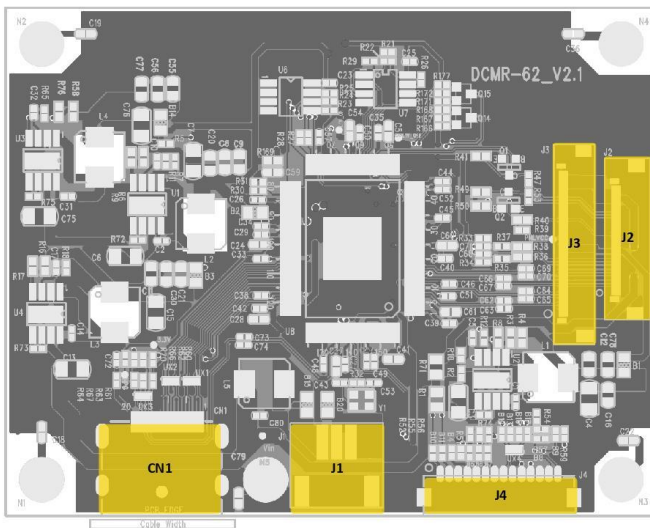


Fig 5. Connector Overview

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

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

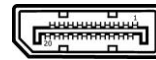


Fig 8. DisplayPort Connector Pin Config.

OSD, I²C, ISP Interface Connector (J4)

The OSD, I²C, ISP Interface Connector (J4) can be used for different purposes. An OSD-keyboard can be connected, the I²C-bus accessed or the board programmed by this interface. The connection is optional.

Table 20. OSD, I²C, 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 ² C SDA	I/O
9	ISP CLK	ISP-I ² C SCL	I/O
10	Up Key	OSD Key Up	I
11	Sel Key	OSD Key Select	I
12	n.c.	-	-
13	I ² C SDA	EEPROM I ² C SDA	I/O
14	I ² C SCL	EEPROM I ² 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

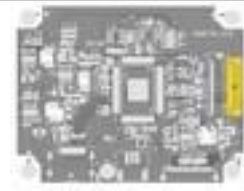


Fig 10. I-PEX: 20455-030E-02

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

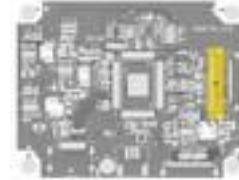


Fig 11. I-PEX: 20455-040E-02

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
ϑ_{ST}	Storage temperature	-10	70	°C
ϑ_{OP}	Operating temperature	0	60	°C

12. Absolute Maximum Ratings

Table 27. Absolute maximum ratings

Symbol	Test item	Min	Max	Unit
ϑ_{ST}	Storage temperature	-15	75	°C
ϑ_{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

Serial number looks in general the following way:

ABCN.NN-YYMMDDXXXX

Table 28. S/N Encoding

Code	Meaning
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

Abbr.	Description
BLU	Backlight Unit
BPC	Bits Per Color
BPP	Bits Per Pixel
DDC	Display Data Channel
DDC/CI	Display Data Channel Command Interface
DP	DisplayPort
DPMS	Display Power Management Service
EDID	Extended Display Identification Data
eDP	Embedded DisplayPort™
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMI	Electromagnetic Interference
GND	Ground
HBR	High Bit Rate
HDCP	High Digital Content Protection
I²C	Inter Integrated Circuit
ISP	In System Programming
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCCS	Monitor Command Control Set
OSD	On Screen Display
PCB	Printed Circuit Board
PCLK	Pixel Clock
PWM	Pulse Width Modulation
REACH	Registration, Evaluation, Authorization and Restriction of Chemicals
RoHS	Restriction of Hazardous Substances
SMT	Surface Mounted Technology
TFT	Thin-Film Transistor
THT	Through Hole Technology
VCP	Virtual Control Panel
VESA	Video Electronics Standards Association

16. Revision History

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

17. Legal Information

17.1. Disclaimers

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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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