

BR420L

LED Display Control Board



Specifications

Change History

Document Version	Release Date	Description
V1.0.1	2026-09-04	• Added certification. • Added the leakage current.
V1.0.0	2026-08-05	First release.

Introduction

BR420L is an LED display control board developed by NovaStar Tech Co., Ltd. (hereinafter referred to as NovaStar). Built in with a power module, it can convert 90 Vac to 264 Vac input into DC power to directly drive the modules. Furthermore, the product is equipped with comprehensive protection against undervoltage, overvoltage, overcurrent, overpower, and short-circuit, significantly enhancing overall system safety, efficiency, and reliability.

For PWM driver ICs, the maximum load capacity per card is:

- 512×512@60Hz (For 8 bit video sources)
- 512×384@60Hz (For 10 bit and 12 bit video sources)



Note

For PWM driver ICs, the maximum load capacity per card when used with COEX controllers is:

- 512×512@60Hz (For 10 bit video sources)
- 512×384@60Hz (For 12 bit video sources)

Certifications

RoHS

If the product lacks the certifications required for sale in the destination country or region, please contact NovaStar promptly for confirmation or assistance. Otherwise, the customer shall bear any resulting legal risks and liabilities, and NovaStar reserves the right to seek compensation.

Features

- Power module and receiving card in one package

The product can convert input voltage of 90 VAC to 264 VAC into 4.0 V (common anode) DC power to directly drive the modules. Furthermore, it offers comprehensive protection against undervoltage, overvoltage, overcurrent, overpower, and short-circuit.

- Color management

Support standard (Rec.709/DCI-P3/Rec.2020) and custom color gamuts, enabling more precise colors on the screen.

- 18 bit+

Improve the LED display grayscale by 4 times, effectively eliminating grayscale loss at low brightness levels and delivering exceptionally smooth images.

- HDR

- Support HDR10 and comply with the SMPTE ST 2084 and SMPTE ST 2086 standards.
- Support HLG.

- Pixel Level Brightness and Chroma Calibration

Work with NovaStar's calibration system to calibrate the brightness and chroma of each pixel, effectively eliminating differences and enabling high consistency for both brightness and chroma.

- Quick Adjustment of Dark or Bright Lines

The different brightness of seams caused by splicing of modules or cabinets can be corrected to improve the visual experience. The correction is easy and takes effect immediately.

- Multi-batch Adjustment

Adjust the brightness and chroma of cabinets or modules to minimize display discrepancies caused by variations in production batches.

- Low Latency

Low Latency is enabled by default. For PWM driver ICs, the latency of the video source at the receiving card end can be reduced to 1 frame. To use low latency with DCLK continuous PWM driver ICs, a customized firmware is required.

- 3D

Work with the controller that supports 3D function to enable 3D output.

- 90° Image Rotation

The display image can be rotated in multiples of 90° (0°/90°/180°/270°).

- Mapping 1.1

The cabinet displays the Ethernet port, receiving card, and controller numbers in different colors, clearly showing the physical locations and connection topology of receiving cards.

- Settings of a Stored Image in the Receiving Card

The image displayed during startup, or displayed when the Ethernet cable is disconnected or there is no video signal.

- Temperature and Voltage Monitoring

Real-time monitoring of the temperature and voltage of the receiving card, without the need for other external devices.

- Module Flash Management

For modules with flash memory, the information stored can be managed, allowing for the storage and readback of calibration coefficients and module IDs.

- One-click to Apply Calibration Coefficients in Module Flash

For modules with flash memory, when the Ethernet cable is disconnected, users can hold down the self-test button on the cabinet to upload the calibration coefficients in the module Flash to the receiving card.

- Cabinet LCD

The LCD module of the cabinet can display the temperature, voltage, single runtime and total runtime of the receiving card.

- Bit Error Detection

Monitor the number of erroneous packets in the Ethernet data transmission of the receiving card to help troubleshoot network communication problems.

- Detection of Ethernet Cable Disconnections

Monitor the number of times the Ethernet cable to the receiving card is disconnected, assisting in identifying potential communication link issues.

- Firmware Program Readback

The receiving card firmware program can be read back and saved to the local computer.

- Configuration Parameter Readback

The receiving card configuration parameters can be read back and saved to the local computer.

- Loop Backup

The receiving card and controller form a loop via the primary and backup line connections. When a fault occurs at a location of the lines, the screen can still display the image normally.

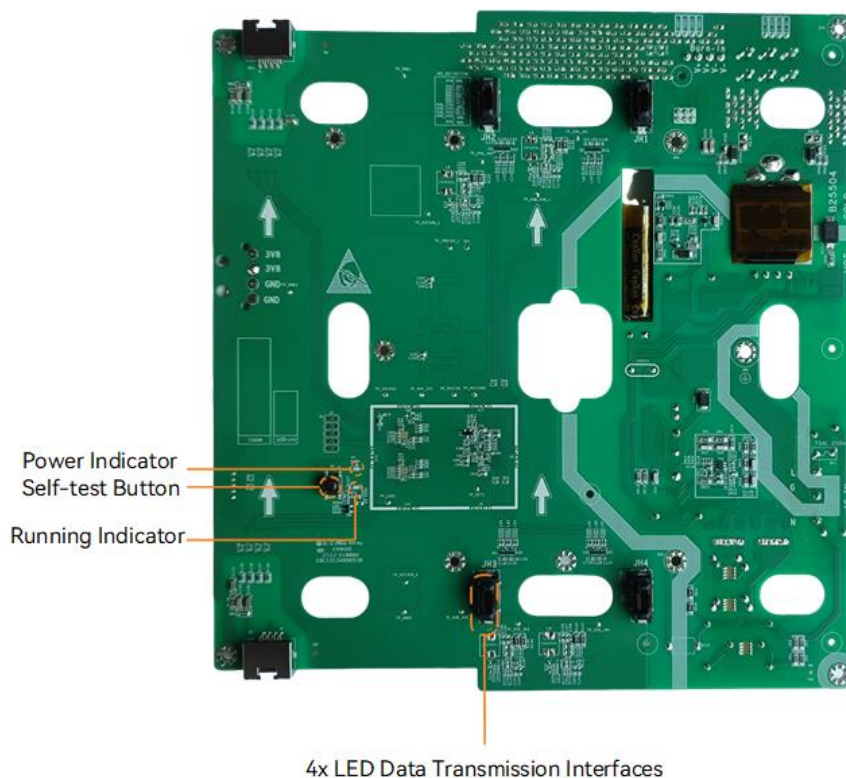
- Dual Backup of Configuration Parameters

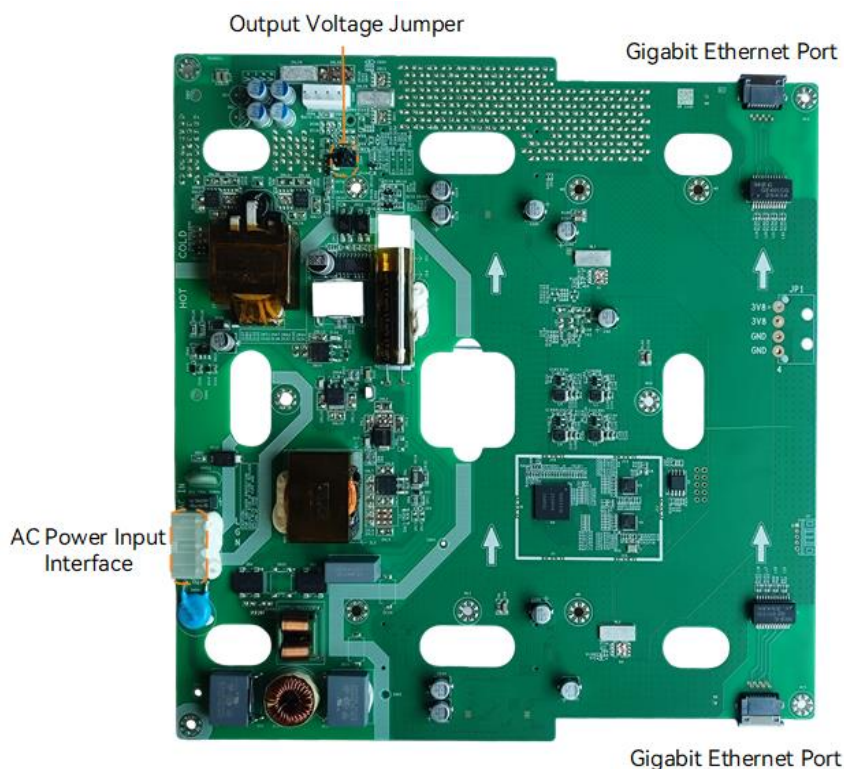
The receiving card configuration parameters are stored in both the application area and factory area of the receiving card at the same time. Users usually use the configuration parameters in the application area. If necessary, users can restore the configuration parameters in the factory area to the application area.

- Dual Program Backup

Two copies of the firmware program are stored in the receiving card at the factory to avoid the problem that the receiving card may get stuck abnormally during program update.

Appearance





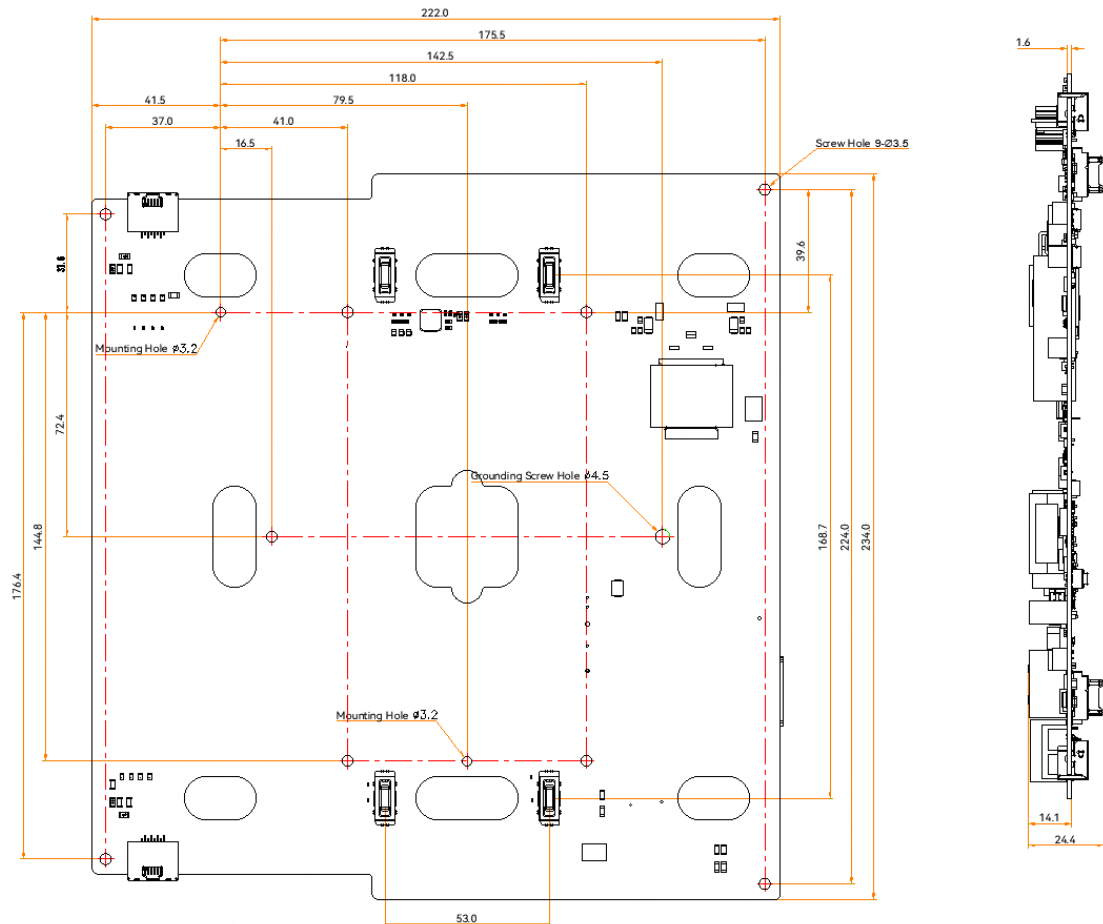
Product images are for reference only. The actual product may vary.

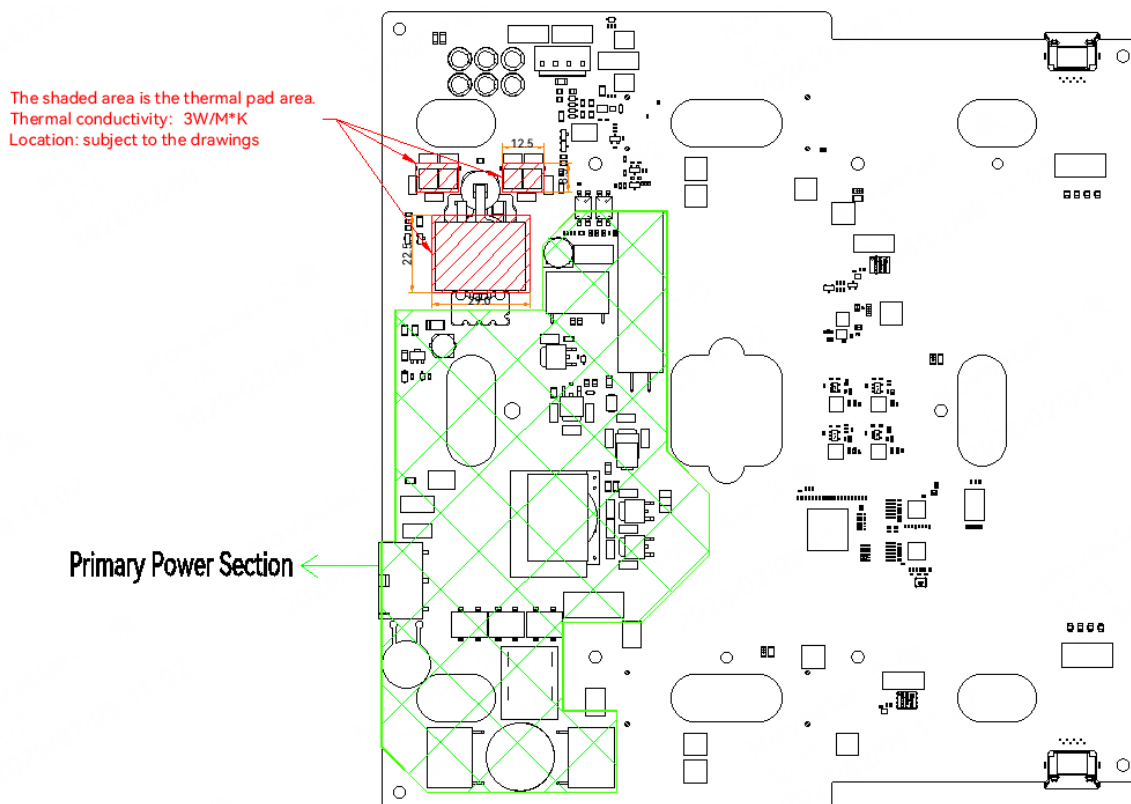
Indicators

Indicators	Color	Status	Description
Running indicator	Green	Flashing once every 1s	The receiving card is functioning normally. Ethernet cable connection is normal, and video source input is available.
		Flashing once every 3s	Ethernet cable connection is abnormal.
		Flashing 3 times every 0.5s	Ethernet cable connection is normal, but video source input is unavailable.
		Flashing once every 0.2s	The receiving card failed to load the program in the application area and is now using the backup program.
		Flashing 8 times every 0.5s	A redundancy switchover occurred on the Ethernet port and the loop backup has taken effect.
Power indicator	Red	Always on	The power input is normal.

Dimensions

The board thickness is not greater than 2.0 mm, and the total thickness (board thickness + thickness of components on the top and bottom sides) is not greater than 25.0 mm.





Tolerance: ± 0.3 Unit: mm

Note

- For molding or installation cutouts, please contact NovaStar for a higher-precision structural drawing.
- The thermal conductive pad and silicone insulation pad are not included with the product. You will need to adhere them yourself according to the specified positions and sizes in the diagram. Attach the thermal conductive pad to the card, ensuring the thickness is appropriate for the available space in the cabinet and that it is compressed when in place. The silicone insulation pad should be adhered to the cabinet.
- The green shaded area in the diagram is the primary power section. Ensure a safety distance of at least 5 mm between this area and the metal conductor of the cabinet. If this distance is not met, add a silicone insulation pad for additional insulation. Design the silicone pad to extend more than 5 mm beyond the primary power section.
- For other areas, maintain a safety distance of at least 2 mm from the cabinet.
- The silicone pad should be 0.23 mm thick, with a voltage resistance of ≥ 4 kV AC and a thermal conductivity of ≥ 1.6 W/(m·K).

Pins

JH1					
HUB_VCC4.0V1	21	21	24	GND	
614_4.0V	1	1	20	GND	
614_4.0V	2	2	19	M_MD1_GCLK_P	
GND	3	3	18	M_MD1_GCLK_N	
GND	4	4	17	GND	
GND	5	5	16	M_MD1_TX_P	
GND	6	6	15	M_MD1_TX_N	
HUB_VCC4.0V1	7	7	14	GND	
HUB_VCC4.0V1	8	8	13	M_MD1_RX_P	
HUB_VCC4.0V1	9	9	12	M_MD1_RX_N	
HUB_VCC4.0V1	10	10	11	GND	
HUB_VCC4.0V1	22	22	23	GND	
GND	G1	G1	G2	GND	

BA21_24ET_2B_CFC

JH3					
HUB_VCC4.0V2	21	21	24	GND	
614_4.0V	1	1	20	GND	
614_4.0V	2	2	19	M_MD3_GCLK_P	
GND	3	3	18	M_MD3_GCLK_N	
GND	4	4	17	GND	
GND	5	5	16	M_MD3_TX_P	
GND	6	6	15	M_MD3_TX_N	
HUB_VCC4.0V2	7	7	14	GND	
HUB_VCC4.0V2	8	8	13	M_MD3_RX_P	
HUB_VCC4.0V2	9	9	12	M_MD3_RX_N	
HUB_VCC4.0V2	10	10	11	GND	
HUB_VCC4.0V2	22	22	23	GND	
GND	G1	G1	G2	GND	

BA21_24ET_2B_CFC

JH2					
HUB_VCC4.0V1	21	21	24	GND	
614_4.0V	1	1	20	GND	
614_4.0V	2	2	19	M_MD2_GCLK_P	
GND	3	3	18	M_MD2_GCLK_N	
GND	4	4	17	GND	
GND	5	5	16	M_MD2_TX_P	
GND	6	6	15	M_MD2_TX_N	
HUB_VCC4.0V1	7	7	14	GND	
HUB_VCC4.0V1	8	8	13	M_MD2_RX_P	
HUB_VCC4.0V1	9	9	12	M_MD2_RX_N	
HUB_VCC4.0V1	10	10	11	GND	
HUB_VCC4.0V1	22	22	23	GND	
GND	G1	G1	G2	GND	

BA21_24ET_2B_CFC

JH4					
HUB_VCC4.0V2	21	21	24	GND	
614_4.0V	1	1	20	GND	
614_4.0V	2	2	19	M_MD4_GCLK_P	
GND	3	3	18	M_MD4_GCLK_N	
GND	4	4	17	GND	
GND	5	5	16	M_MD4_TX_P	
GND	6	6	15	M_MD4_TX_N	
HUB_VCC4.0V2	7	7	14	GND	
HUB_VCC4.0V2	8	8	13	M_MD4_RX_P	
HUB_VCC4.0V2	9	9	12	M_MD4_RX_N	
HUB_VCC4.0V2	10	10	11	GND	
HUB_VCC4.0V2	22	22	23	GND	
GND	G1	G1	G2	GND	

BA21_24ET_2B_CFC

Pin Definitions (Taking JH1 as an example)					
/	HUB_VCC4.0V1	21	24	GND	/
/	614_4.0V	1	20	GND	/
/	614_4.0V	2	19	M_MD1_GCLK_P	LVDS signal output
/	GND	3	18	M_MD1_GCLK_N	
/	GND	4	17	GND	/
/	GND	5	16	M_MD1_TX_P	LVDS signal input
/	GND	6	15	M_MD1_TX_N	
/	HUB_VCC4.0V1	7	14	GND	/
/	HUB_VCC4.0V1	8	13	M_MD1_RX_P	LVDS signal output
/	HUB_VCC4.0V1	9	12	M_MD1_RX_N	
/	HUB_VCC4.0V1	10	11	GND	/
/	HUB_VCC4.0V1	22	23	GND	/
/	GND	G1	G2	GND	/

Electrical Specifications

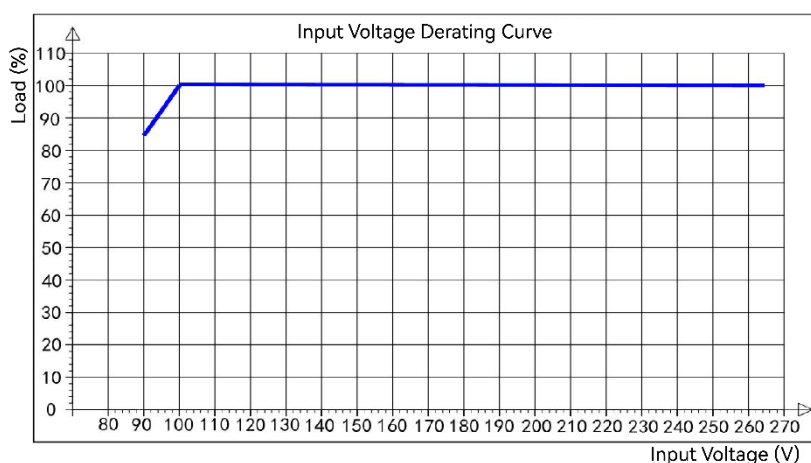
Input Specifications

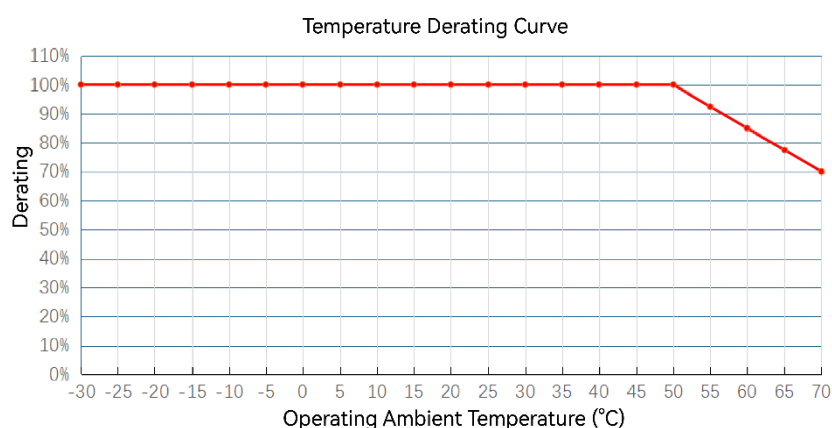
Input Voltage	90 VAC to 264 VAC
Nominal Input	100 VAC to 240 VAC
Frequency Range	47 Hz to 63 Hz
Starting Voltage	> 70 VAC
Maximum Input Current	1.5 A
Inrush Current	Cold start: 100 A at 240 VAC, 50 A at 100 VAC
Power Factor	@240 VAC, ≥ 0.88 ; @100VAC, ≥ 0.97 (tested at 20 A)
Current Harmonics	GB17625.1; EN61000-3-2, -3
Standby Power Consumption	≤ 4 W
Input Fuse	T5AL/250 VAC

Output Specifications

Output Current	20 A (Rated) Note: The peak current is tested with a pulse width of less than 100 ms and at an ambient temperature of 30°C.
Output Voltage	Default: 4.0 V Note: Offers three adjustable settings (3.8 V/4.0 V/4.2 V), which can be changed by simply connecting a jumper cap.
Output Voltage Accuracy	$\pm 2.0\%$
Line Regulation	$\pm 2.0\%$
Load Regulation	$\pm 2.0\%$
Output Ripple Noise	≤ 200 mV Note: In an environment of 25°C, the bandwidth is set to 20 MHz. A 0.1 μ F ceramic capacitor and a 10 μ F electrolytic capacitor are connected in parallel at the output for testing.

Temperature Coefficient	Pending
Dynamic Load Performance	0% to 50% load and 50% to 100% load, < 10%
Efficiency	@240 VAC, 88%, CH1 20 A @100 VAC, 84%, CH1 20 A
Output Rise Time	30.0 ms max Note: Rise time is defined as the time it takes for the output voltage to increase from 10% to 90%. This is tested with a 0.1 μ F ceramic capacitor and a 10 μ F electrolytic capacitor connected in parallel at the output.
Start-up Delay Time	Max 1s at 220 VAC
Output Hold Time	@240 VAC, 15 ms @100 VAC, 10 ms
Output Voltage Overshoot	Max 10% Note: All DC output currents should range from minimum to maximum values.
Capacitive Load	20000 μ F
Ratio Radiation Emission	Pending
Switching Frequency	Pending
Power Temperature Derating	-20°C to +70°C (Above 50°C, load capacity is reduced by 1.5% for every additional 1°C.)
Power Input Voltage Derating	100% load at 100 VAC to 264 VAC with no derating
MTBF	$\geq$ 150,000 hours at 25°C ambient temperature, with full load and normal input





Protection

Input Undervoltage Protection	Engages above 70 VAC, disengages below 65 VAC
Output Overvoltage Protection	< 6.5 V, self-recovery
Output Overcurrent Protection	Triggered at 1.3 to 1.6 times of rated current
Output Overpower Protection	Triggered at 1.3 to 1.6 times of rated power
Output Short-circuit Protection	Self-recovery

Safety

Insulation Resistance	Input to output 500 VDC, 100 MΩ min (at room temperature) Input to FG 500 VDC 100 MΩ min (at room temperature) Output to FG 500 VDC 100 MΩ min (at room temperature)
Insulation Withstand Voltage	Input to output (I/P-O/P): 3.0 kVAC / 10 mA Input to case (I/P-CASE): 1.8 kVAC / 10 mA Output to case (O/P-CASE): 500 VDC / 10 mA Note: This specifies the AC withstand voltage. The DC withstand voltage is 1.414 times the AC value, with the same leakage current limit.
Ground Resistance	< 0.1 Ω
Leakage Current	IEC 62368-1

 Note

If there are lightning protection components in the circuit, the following steps should be taken during the voltage withstand test after disconnecting the air gap tube:

- The input lines (L&N) need to be short-circuited together, and all the output lines need to be short-circuited together.
- Input to output: Input short-circuit line to output short-circuit line test.
- Input to FG: Input short-circuit line to FG.

EMC

Conducted Emission	GB/T9254.1-2021/EN55032/FCC, Class A
Radiated Emission	GB/T9254.1-2021/EN55032/FCC, Class A
Power Fluctuation and Flicker	Pending
Radiated Susceptibility	EN55024; EN61000-4-2, 3, 4, 5, 6, 8, 11
Conducted Susceptibility	EN55024; EN61000-4-2, 3, 4, 5, 6, 8, 11
Surge Susceptibility	GB17626.5/IEC61000-4-5 Performance Criteria: B DM: ± 2 kV, CM: ± 4 kV
EFT Immunity	GB17626.4/IEC61000-4-4 Performance Criteria: B ± 3 kV
ESD Immunity	GB17626.2/IEC61000-4-2 Performance Criteria: B Contact ± 4 kV, Air ± 8 kV
Voltage Fluctuation and Flicker	Pending
Voltage Drop	GB17626.11/IEC61000-4-11 Performance Criteria: B/C

Voltage Drop Requirements:

Voltage Drop	Duration	Performance Criteria
0% Ut	10 ms	B
70% Ut	500 ms	C
40% Ut	200 ms	C
0% Ut	5000 ms	C



Caution

It is required to comply with the above-mentioned standards as a whole system.

Specifications

Maximum Resolution	For PWM driver ICs, the maximum load capacity per card is: • 512×512@60Hz (For 8 bit video sources) • 512×384@60Hz (For 10 bit and 12 bit video sources)	
Operating Environment	Temperature	-20°C to +70°C
	Humidity	10% RH to 90% RH, non-condensing
	Altitude	-60 m to +5000 m Note: For every 100 meters above 2000 meters in altitude, the maximum operating temperature decreases by 0.5°C.
Storage Environment	Temperature	-40°C to +85°C
	Humidity	5% RH to 95% RH, non-condensing
	Altitude	< 5000 m
Physical Specifications	Dimensions	222.0 mm × 234.0 mm × 24.4 mm
	Net weight	291.3 g Note: It is the weight of a single receiving card only.
Packing Information	Packaging	An antistatic bag and anti-collision foam are provided for each receiving card. Each packing box contains 28 receiving cards.
	Packing box	635.0 mm × 595.0 mm × 283.0 mm

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