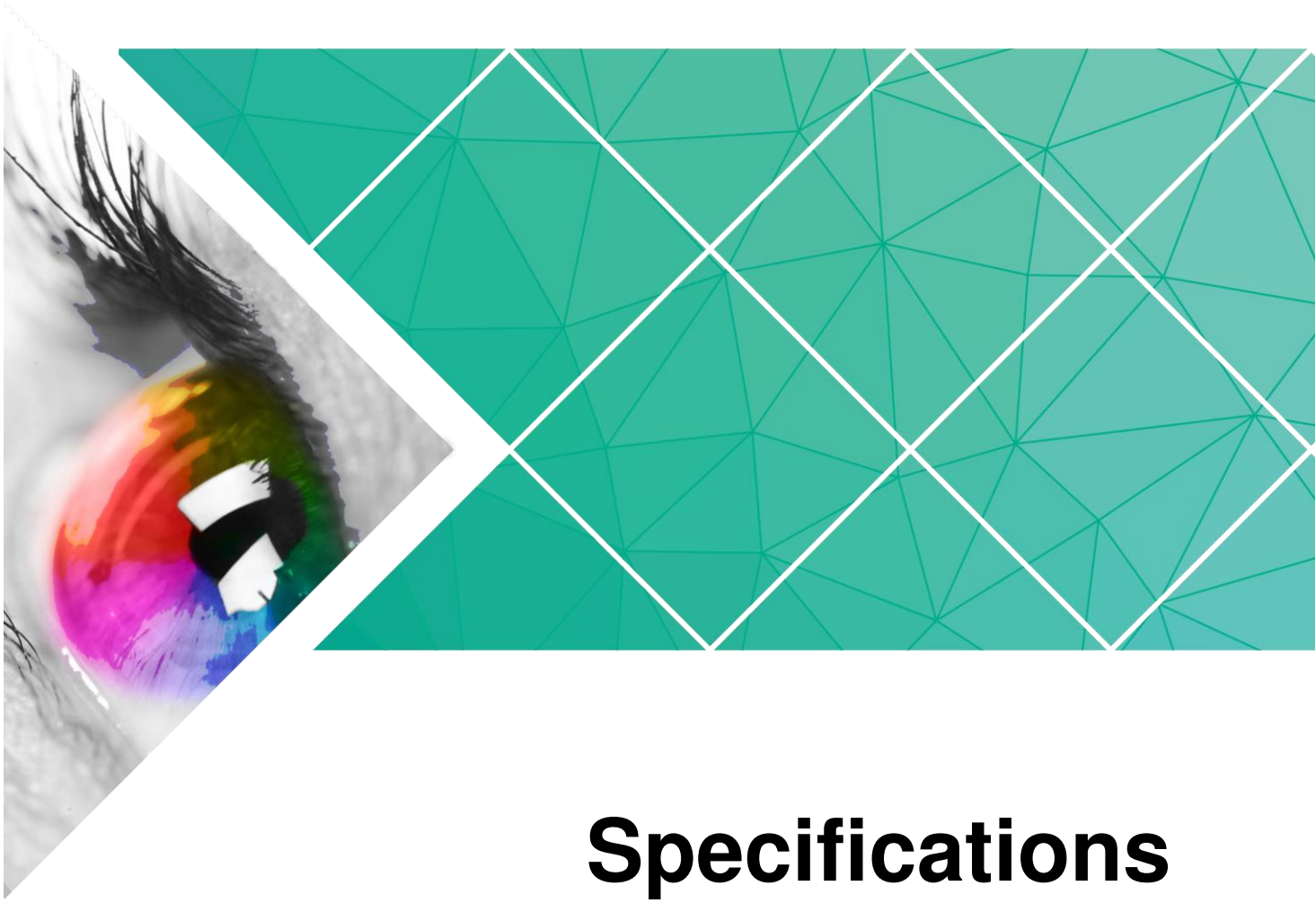
A10s Plus

Receiving Card



Specifications

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Change History

Document Version	Firmware Version	Release Date	Description
V1.0.0	V4.6.0.0	2019-05-24	First release

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1 Overview

A10s Plus is a high-end receiving card developed by NovaStar. It has a small size and features a large loading capacity, with a single card loading up to 512×512 pixels. It can support up to 32 groups of parallel data or 64 groups of serial data.

The A10s Plus can work with the MCTRL R5 independent controller to make the display rotate at any angle. It can also work with the large loading capacity MCTRL4K independent controller to support HDR10 and HLG video inputs, allowing for a higher dynamic brightness range, larger color space, a smoother and more realistic image.

The A10s Plus supports pixel level brightness and chroma calibration by working with NovaLCT and NovaCLB to perform calibration on each pixel. It can effectively remove color discrepancies and greatly improve LED display image consistency. In addition, it also supports image rotation in 90° increments, creating a richer image and offering users the ultimate visual experience.

On-site setup, operation, and maintenance were all taken into account when designing the hardware and software of the A10s Plus, allowing for an easier setup, more stable operation, and more efficient maintenance.

Advanced Hardware Design:

- The small hardware footprint saves cabinet space and is suitable to a variety of applications.
- Uses dust-resistant high-density connector to limit effects of dust and vibration, resulting in high stability and reliability.
- Integrated network transformer features simple design and improved electromagnetic compatibility.

Useful Software Design:

- Supports up to 1/64 scan.
- Supports the following functions when working with NovaLCT (V5.2.0 and later)
  - Supports random order scanning of module.
  - Lights the modules with data row extracting and channel extracting.
  - Supports precise grayscale correction.
  - Supports individual Gamma adjustment for RGB.
  - Supports bit error detection.
- Supports HDR function.

- Supports low latency function.
- Supports 18Bit+ to display image with high brightness or low grayscale.
- Supports ClearView high image quality display.
- Supports LVDS transmission (supported by dedicated firmware program).
- Supports smart module (supported by dedicated firmware program).
- Supports quick seam correction.
- Supports 3D function.
- Supports auto module calibration.
- Supports Mapping function.
- Supports setting of pre-stored image on receiving card.
- Supports module Flash management.
- Supports voltage and temperature monitoring of card without use of peripherals.
- Supports cabinet LCD.
- Supports image rotation in 90° increments.
- Supports display rotation at any angle.

2 Features

2.1 Improvements to Display Effect

Features	Description
Individual Gamma adjustment for RGB	Working with the independent controller that support this feature and NovaLCT(V5.2.0), A10s Plus supports adjustment of red Gamma, green Gamma and blue Gamma, which can effectively control image non-uniformity under low grayscale and white balance offset, allowing a for more realistic image.
Precise grayscale correction	Working with Precise Grayscale Tool and NovaLCT, A10s Plus supports further correction of the calibrated display, which can control the grayscale precisely. This feature can also assist other display technologies, such as 18Bit+, ClearView and individual Gamma adjustment for RGB, allowing the screen to display a more realistic image.
HDR function	Supports HDR10 and HLG video sources. A10s Plus can work with the large loading capacity MCTRL4K independent controller to support HDR10 and HLG video inputs, allowing for a higher dynamic brightness range, larger color space, a smoother and more realistic image.
Low latency	A10s Plus can reduce the frame latency of the video source on the receiving card end to one frame (only when using modules with driver IC with built-in RAM).
18Bit+	Activation of 18Bit+ mode in NovaLCT can improve LED display grayscale by 4 times, avoiding grayscale loss due to low brightness and allowing for a finer image.
ClearView	Enable ClearView in NovaLCT to make texture, size, and contrast adjustments on different areas

	of the display based on the Human Visual System, creating a more realistic image.
Display rotation at any angle	When using A10s Plus with MCTRL R5, configure the display image in SmartLCT to rotate at any angle and present a variety of images.
Pixel level brightness and chroma calibration	Working with NovaLCT and NovaCLB, A10s Plus supports brightness and chroma calibration on each pixel.
Image rotation in 90° increments (calibration not supported after rotation)	In NovaLCT, the image on the screen can be set to rotate in multiples of 90° (90°, 180°, 270° and 360°).
Quick seam correction	Working with NovaLCT, A10s Plus supports quick adjustment of bright and dark lines, which can remove the seams between modules or cabinets.
3D function	In NovaLCT or operation panel of controllers which support 3D function, you can enable 3D function and set 3D parameters to allow LED screen to display 3D effects.

2.2 Improvements to Maintainability

Features	Description
Supports smart module (supported by dedicated firmware program).	The smart module is composed of Flash and MCU. Flash can store calibration coefficients and module information. MCU can communicate with the receiving card to monitor temperature, voltage and ribbon cable communication status for the module. Working with the driver chip, MCU also supports open circuit detection of LED. The smart module allows for a smaller monitoring unit, requiring no independent monitoring card and saving cabinet space.
LVDS transmission (supported by dedicated firmware program)	Low-voltage differential signaling (LVDS) transmission is used, which reduces the number of data cables that connect the HUB board to the module, increases the transmission distance, improves the signal transmission quality and electromagnetic compatibility, and better stabilizes the image output.
Auto module calibration	After the module (with module Flash) has been replaced and power is supplied, the receiving card can automatically read the new module ID and calibration coefficients, and save them to the receiving card.
Mapping function	After enabling the Mapping function in NovaLCT,

Features	Description
	target cabinet will display the receiving card number and Ethernet port information, allowing user to view the receiving card's location and wiring route.
Setting of pre-stored image on receiving card.	In NovaLCT, a specified image can be set as the LED screen startup image or as the image to be displayed on LED screen when the Ethernet cable is disconnected or no video source signal is available.
Module Flash Management	In NovaLCT, the information stored in module Flash can be managed.
Voltage and temperature monitoring of receiving card	The voltage and temperature of the receiving card can be monitored without using peripherals. The monitoring data can be checked in NovaLCT.
Cabinet LCD	• Supports NovaStar's general 5-pin LCD module. The LCD module is connected to the HUB board to display temperature, voltage, single operating time and total operating time of the receiving card. • Works with NovaLCT (V5.2.0 and later) to support cabinet LCD backlight control. • Works with NovaLCT (V5.2.0 and later) to support LCD run time resetting.
One-click application of calibration coefficients saved in module Flash	In the event of network outage, hold down the self-test button to read the calibration coefficients in module Flash back to the receiving card.

2.3 Improvements to Hardware Reliability

Features	Description
Dual-card backup and status monitoring	• In an environment with requirements for high reliability, two A10s Plus receiving cards can be mounted onto a single HUB board. In the case that main receiving card fails, the standby card will serve to ensure uninterrupted operation of the display. • Works with NovaLCT (V5.2.0 and later) to support status monitoring of main and backup receiving cards.
Status detection of dual power supplies	Two power supplies can be simultaneously connected. Their working status can be detected.
Loop backup	HUB's Ethernet port improves the reliability for the serial connection of the receiving card through main and backup redundant mechanism. If either

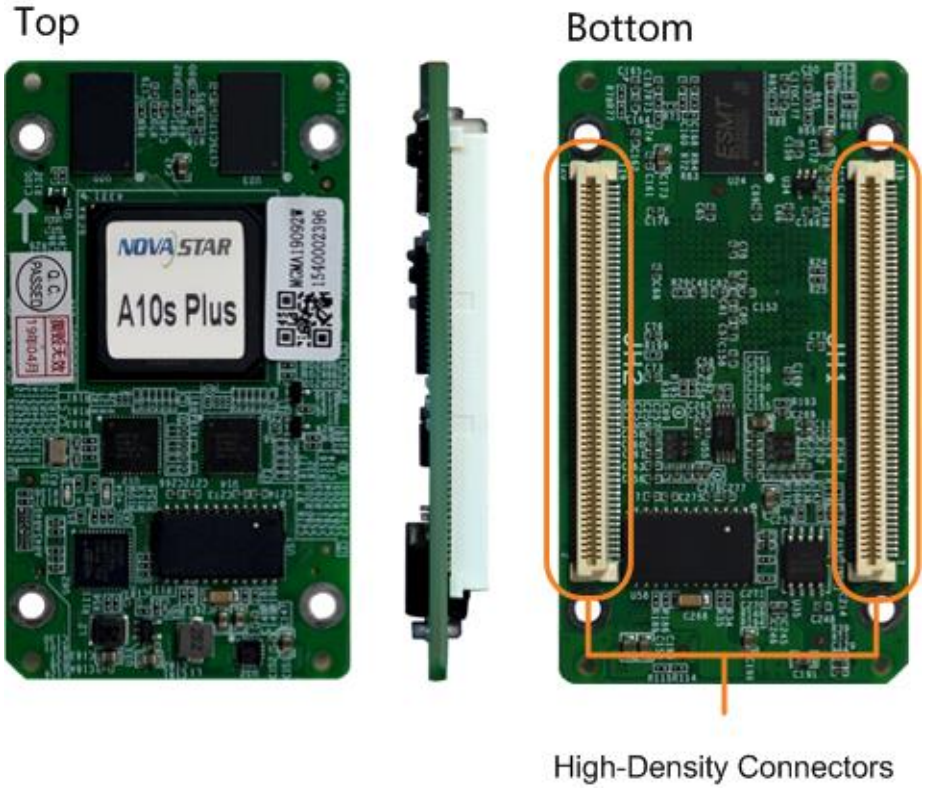
Features	Description
	main or backup serial connection lines fail, the other will begin to work to ensure normal operation of the display.

2.4 Improvements to Software Reliability

Features	Description
Bit error detection	Working with NovaLCT (V5.2.0 and later), A10s Plus can monitor the Gigabit Ethernet communication quality between sending device and receiving card, or between receiving cards. The number of errors can be recorded to help troubleshoot network communication problems.
Readback of firmware version	In NovaLCT, the firmware versions of the receiving card can be read back.
Dual-backup of calibration coefficients	Calibration coefficients can be saved in both the factory partition and application partition at the same time. • Calibration coefficients in the factory partition are factory values. • Calibration coefficients configured by users can be saved in the application partition and can be restored to the factory values by users.
Backup and readback of receiving card configuration parameters	• In NovaLCT, the receiving card configuration parameters can be backed up to the receiving card. • In NovaLCT, the receiving card configuration parameters can be read back.

3 Hardware

3.1 Appearance



All product images shown in this document are for illustration purpose only. Actual product may vary.

Models of the female socket (Receptacle) and male socket (PLUG) of high-density connectors used by A10s Plus are shown in Table 3-1.

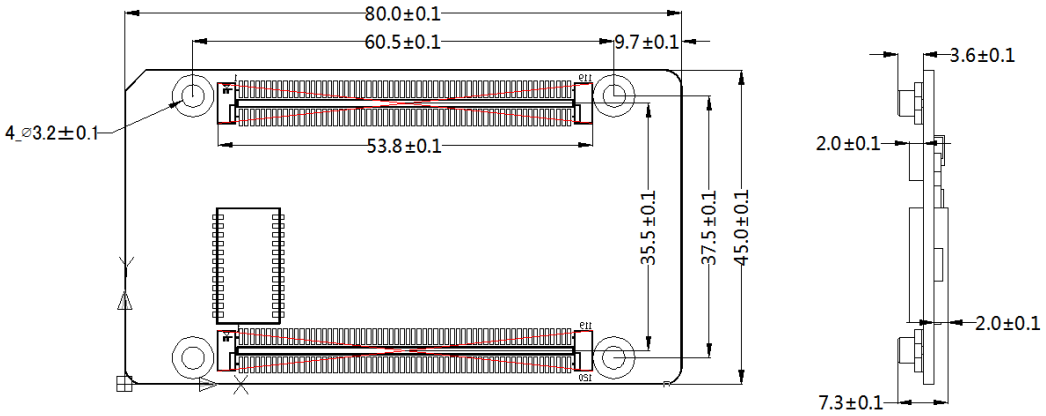
Table 3-1 Model of high-density connector

Type	Brand	Material Code
Receptacle	Amphenol FCI	10140609-121802LF
PLUG	Amphenol FCI	10140607-121802LF

3.2 Dimensions

PCB board thickness is ≤ 2.0 mm, and the total thickness (PCB board thickness + thickness of both front and back panels) is ≤ 7.5 mm.

Unit of measurement on below chart is “mm”. Ground connection is enabled for mounting holes (GND).

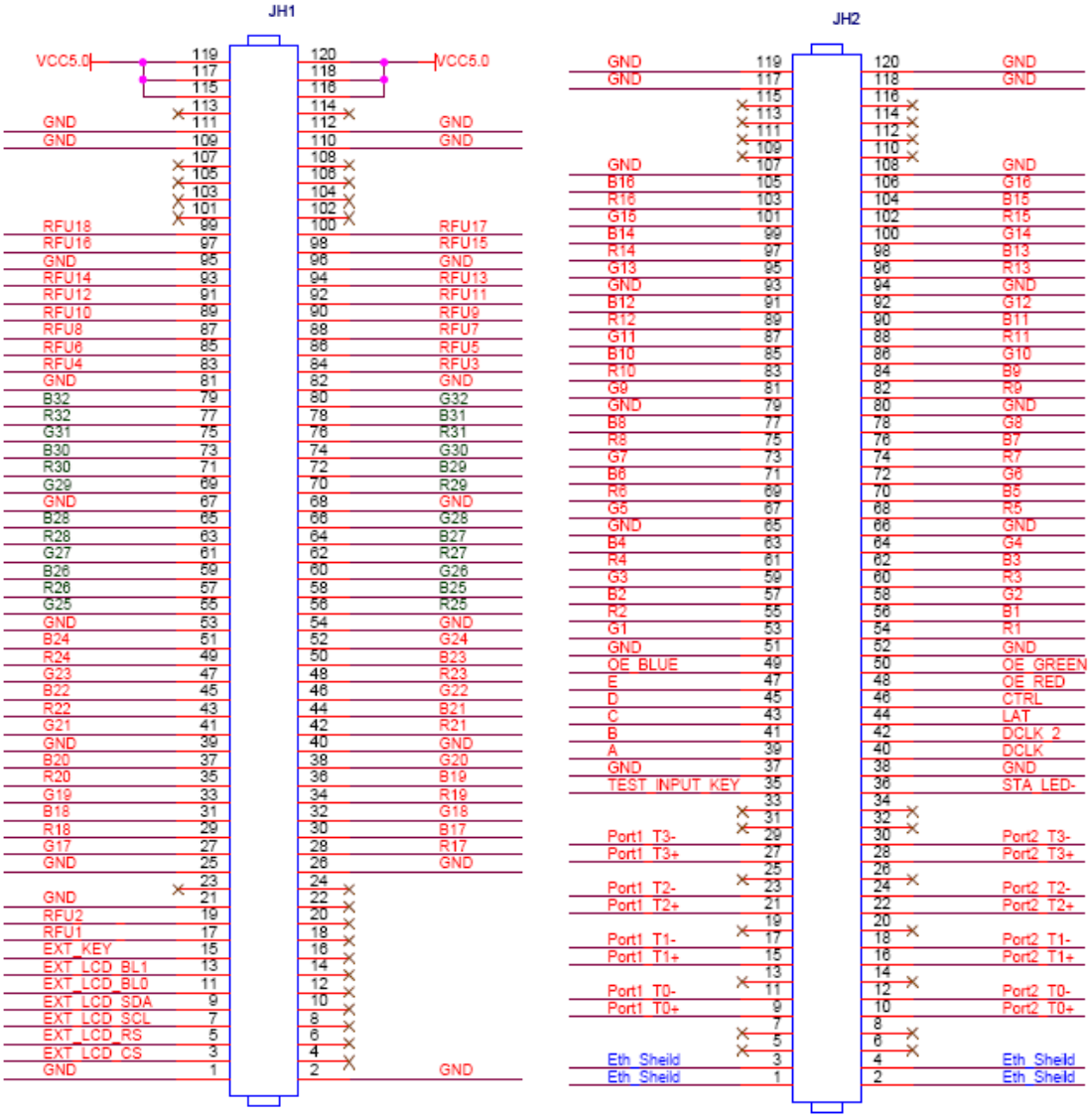


3.3 Indicators

Indicator	Status	Description
Status indicator (green)	Flashing every other 1s	Receiving card is functioning normally. Ethernet cable connection is normal, and video source input is available.
	Flashing every other 3s	Receiving card is functioning normally, but Ethernet cable connection is abnormal.
	Flashing for 3 times every other 1s	Receiving card is functioning normally. Ethernet cable connection is normal, but no video source input is available.
	Flashing every other 0.5s	Program loading fails in normal operating state, currently loading backup operating program.
	Flashing for 8 times every other 1s	Sending card's backup Ethernet port is now active. Receiving card is functioning normally.
Power indicator (red)	Always on	It is always on after the power is on.

3.4 Pin Definition (Top)

3.4.1 Pins for Parallel Data (32 Groups)



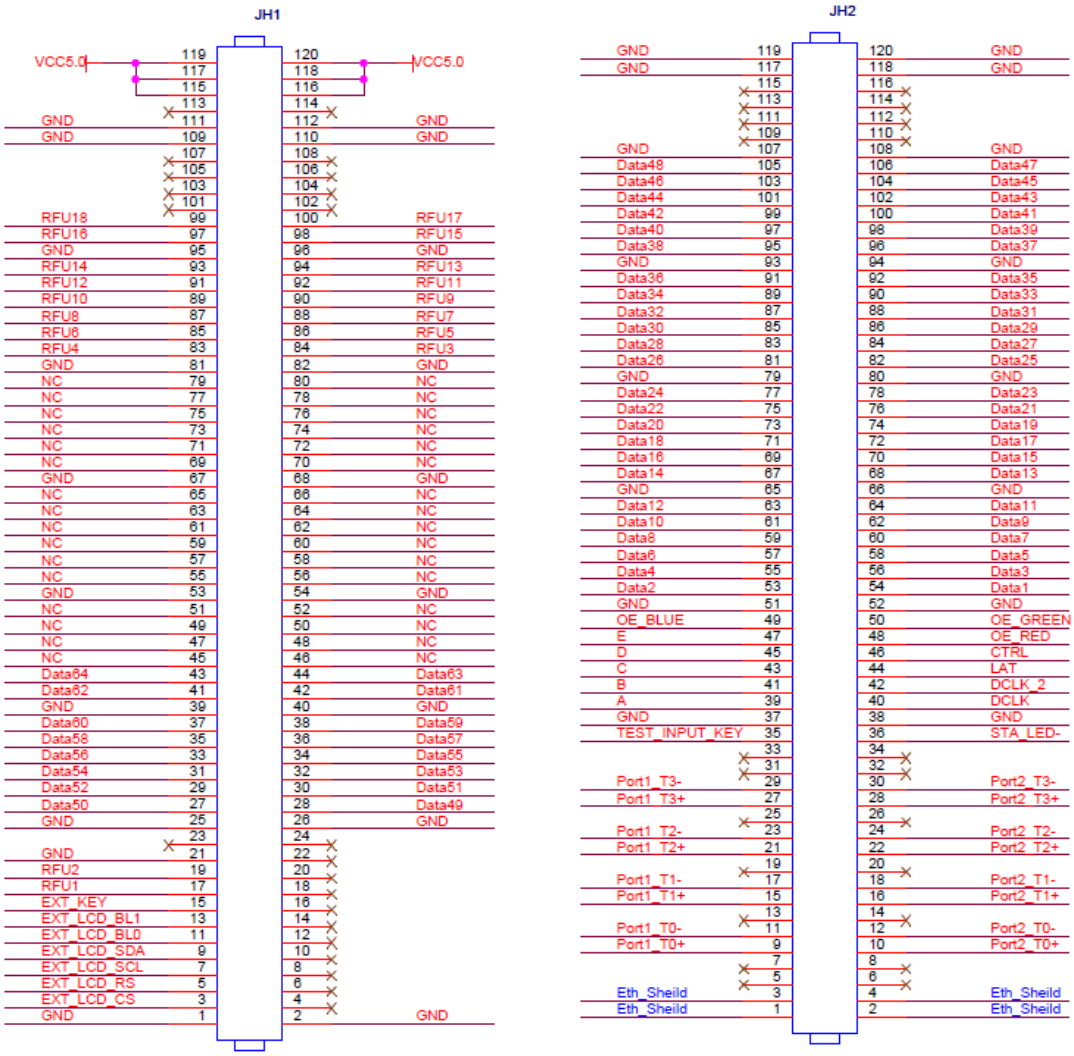
JH1							
		GND	1	2	GND		
LCD	LCD CS signal	EXT_LCD_CS	3	4	NC		
	LCD RS signal	EXT_LCD_RS	5	6	NC		
	LCD clock signal	EXT_LCD_SCL	7	8	NC		
	LCD data signal	EXT_LCD_SDA	9	10	NC		
	LCD backlight signal 1	EXT_LCD_BL0	11	12	NC		
	LCD backlight signal 2	EXT_LCD_BL1	13	14	NC		
	LCD control button	EXT_KEY	15	16	NC		
Note 4	/	RFU1	17	18	NC		
	/	RFU2	19	20	NC		
		GND	21	22	NC		
		NC	23	24	NC		
		GND	25	26	GND		

JH1							
	/	G17	27	28	R17	/	
	/	R18	29	30	B17	/	
	/	B18	31	32	G18	/	
	/	G19	33	34	R19	/	
	/	R20	35	36	B19	/	
	/	B20	37	38	G20	/	
		GND	39	40	GND		
	/	G21	41	42	R21	/	
	/	R22	43	44	B21	/	
	/	B22	45	46	G22	/	
	/	G23	47	48	R23	/	
	/	R24	49	50	B23	/	
	/	B24	51	52	G24	/	
		GND	53	54	GND		
	/	G25	55	56	R25	/	
	/	R26	57	58	B25	/	
	/	B26	59	60	G26	/	
	/	G27	61	62	R27	/	
	/	R28	63	64	B27	/	
	/	B28	65	66	G28	/	
		GND	67	68	GND		
	/	G29	69	70	R29	/	
	/	R30	71	72	B29	/	
	/	B30	73	74	G30	/	
	/	G31	75	76	R31	/	
	/	R32	77	78	B31	/	
	/	B32	79	80	G32	/	
		GND	81	82	GND		
Note 4	/	RFU4	83	84	RFU3	/	Note 4
	/	RFU6	85	86	RFU5	/	
	/	RFU8	87	88	RFU7	/	
	/	RFU10	89	90	RFU9	/	
	/	RFU12	91	92	RFU11	/	
	/	RFU14	93	94	RFU13	/	
		GND	95	96	GND		
Note 4	/	RFU16	97	98	RFU15	/	Note 4
	/	RFU18	99	100	RFU17	/	
		NC	101	102	NC		
		NC	10	10	NC		
		NC	10	10	NC		
		NC	10	10	NC		
		GND	10	11	GND		
		GND	111	11	GND		
		NC	113	11	NC		
Note 1		VCC	115	11	VCC		Note 1
		VCC	117	11	VCC		
		VCC	119	12	VCC		

JH2							
	Chassis ground	Eth_Sheild	1	2	Eth_Sheild	Chassis ground	
	Chassis ground	Eth_Sheild	3	4	Eth_Sheild	Chassis ground	
		NC	5	6	NC		
		NC	7	8	NC		
Gigabit Ethernet Port	/	Port1_T0+	9	10	Port2_T0+	/	Gigabit Ethernet Port
	/	Port1_T0-	11	12	Port2_T0-	/	
		NC	13	14	NC		

JH2							
	/	Port1_T1+	15	16	Port2_T1+	/	
	/	Port1_T1-	17	18	Port2_T1-	/	
		NC	19	20	NC		
	/	Port1_T2+	21	22	Port2_T2+	/	
	/	Port1_T2-	23	24	Port2_T2-	/	
		NC	25	26	NC		
	/	Port1_T3+	27	28	Port2_T3+	/	
	/	Port1_T3-	29	30	Port2_T3-	/	
		NC	31	32	NC		
		NC	33	34	NC		
	Test button	TEST_INPUT_KEY	35	36	STA_LED-	Operating indicator	Note 2
		GND	37	38	GND		
	Line decoding signal	A	39	40	DCLK	1st shift clock output	
	Line decoding signal	B	41	42	DCLK_2	2nd shift clock output	
	Line decoding signal	C	43	44	LAT	Latch signal output	
	Line decoding signal	D	45	46	CTRL	Afterglow control signal	
	Line decoding signal	E	47	48	OE_RED	Display enable	Note 3
Note 3	Display enable	OE_BLUE	49	50	OE_GREEN	Display enable	
		GND	51	52	GND		
	/	G1	53	54	R1	/	
	/	R2	55	56	B1	/	
	/	B2	57	58	G2	/	
	/	G3	59	60	R3	/	
	/	R4	61	62	B3	/	
	/	B4	63	64	G4	/	
		GND	65	66	GND		
	/	G5	67	68	R5	/	
	/	R6	69	70	B5	/	
	/	B6	71	72	G6	/	
	/	G7	73	74	R7	/	
	/	R8	75	76	B7	/	
	/	B8	77	78	G8	/	
		GND	79	80	GND		
	/	G9	81	82	R9	/	
	/	R10	83	84	B9	/	
	/	B10	85	86	G10	/	
	/	G11	87	88	R11	/	
	/	R12	89	90	B11	/	
	/	B12	91	92	G12	/	
		GND	93	94	GND		
	/	G13	95	96	R13	/	
	/	R14	97	98	B13	/	
	/	B14	99	10	G14	/	
	/	G15	10	10	R15	/	
	/	R16	10	10	B15	/	
	/	B16	10	10	G16	/	
		GND	10	10	GND		
		NC	10	11	NC		
		NC	111	11	NC		
		NC	113	11	NC		
		NC	115	11	NC		
		GND	117	11	GND		
		GND	119	12	GND		

3.4.2 Pins for Serial Data (64 Groups)



JH1							
		GND	1	2	GND		
LCD	LCD CS signal	EXT_LCD_CS	3	4	NC		
	LCD RS signal	EXT_LCD_RS	5	6	NC		
	LCD clock signal	EXT_LCD_SCL	7	8	NC		
	LCD data signal	EXT_LCD_SDA	9	10	NC		
	LCD backlight signal 1	EXT_LCD_BL0	11	12	NC		
	LCD backlight signal 2	EXT_LCD_BL1	13	14	NC		
	LCD control button	EXT_KEY	15	16	NC		
Note 4	/	RFU1	17	18	NC		
	/	RFU2	19	20	NC		
		GND	21	22	NC		
		NC	23	24	NC		
		GND	25	26	GND		
	/	Data50	27	28	Data49	/	
	/	Data52	29	30	Data51	/	
	/	Data54	31	32	Data53	/	
	/	Data56	33	34	Data55	/	
	/	Data58	35	36	Data57	/	

JH1							
	/	Data60	37	38	Data59	/	
		GND	39	40	GND		
	/	Data62	41	42	Data61	/	
	/	Data64	43	44	Data63	/	
		NC	45	46	NC		
		NC	47	48	NC		
		NC	49	50	NC		
		NC	51	52	NC		
		GND	53	54	GND		
		NC	55	56	NC		
		NC	57	58	NC		
		NC	59	60	NC		
		NC	61	62	NC		
		NC	63	64	NC		
		NC	65	66	NC		
		GND	67	68	GND		
		NC	69	70	NC		
		NC	71	72	NC		
		NC	73	74	NC		
		NC	75	76	NC		
		NC	77	78	NC		
		NC	79	80	NC		
		GND	81	82	GND		
Note 4	/	RFU4	83	84	RFU3	/	Note 4
	/	RFU6	85	86	RFU5	/	
	/	RFU8	87	88	RFU7	/	
	/	RFU10	89	90	RFU9	/	
	/	RFU12	91	92	RFU11	/	
	/	RFU14	93	94	RFU13	/	
		GND	95	96	GND		
Note 4	/	RFU16	97	98	RFU15	/	Note 4
	/	RFU18	99	100	RFU17	/	
		NC	101	102	NC		
		NC	103	104	NC		
		NC	105	106	NC		
		NC	107	108	NC		
		GND	109	110	GND		
		GND	111	112	GND		
		NC	113	114	NC		
Note 1		VCC	115	116	VCC		Note 1
		VCC	117	118	VCC		
		VCC	119	120	VCC		

JH2							
Gigabit Ethernet Port	Chassis ground	Eth_Sheild	1	2	Eth_Sheild	Chassis ground	Gigabit Ethernet Port
	Chassis ground	Eth_Sheild	3	4	Eth_Sheild	Chassis ground	
		NC	5	6	NC		
		NC	7	8	NC		
	/	Port1_T0+	9	10	Port2_T0+	/	
	/	Port1_T0-	11	12	Port2_T0-	/	
		NC	13	14	NC		
	/	Port1_T1+	15	16	Port2_T1+	/	
	/	Port1_T1-	17	18	Port2_T1-	/	
		NC	19	20	NC		
	/	Port1_T2+	21	22	Port2_T2+	/	
	/	Port1_T2-	23	24	Port2_T2-	/	

JH2							
		NC	25	26	NC		
	/	Port1_T3+	27	28	Port2_T3+	/	
	/	Port1_T3-	29	30	Port2_T3-	/	
		NC	31	32	NC		
		NC	33	34	NC		
	Test button	TEST_INPUT_KEY	35	36	STA_LED-	Operating indicator	Note 2
		GND	37	38	GND		
	Line decoding signal	A	39	40	DCLK	1st shift clock output	
	Line decoding signal	B	41	42	DCLK_2	2nd shift clock output	
	Line decoding signal	C	43	44	LAT	Latch signal output	
	Line decoding signal	D	45	46	CTRL	Afterglow control signal	
	Line decoding	E	47	48	OE_RED	Display enable	Note 3
Note 3	Display enable	OE_BLUE	49	50	OE_GREEN	Display enable	
		GND	51	52	GND		
	/	Data2	53	54	Data1	/	
	/	Data4	55	56	Data3	/	
	/	Data6	57	58	Data5	/	
	/	Data8	59	60	Data7	/	
	/	Data10	61	62	Data9	/	
	/	Data12	63	64	Data11	/	
		GND	65	66	GND		
	/	Data14	67	68	Data13	/	
	/	Data16	69	70	Data15	/	
	/	Data18	71	72	Data17	/	
	/	Data20	73	74	Data19	/	
	/	Data22	75	76	Data21	/	
	/	Data24	77	78	Data23	/	
		GND	79	80	GND		
	/	Data26	81	82	Data25	/	
	/	Data28	83	84	Data27	/	
	/	Data30	85	86	Data29	/	
	/	Data32	87	88	Data31	/	
	/	Data34	89	90	Data33	/	
	/	Data36	91	92	Data35	/	
		GND	93	94	GND		
	/	Data38	95	96	Data37	/	
	/	Data40	97	98	Data39	/	
	/	Data42	99	100	Data41	/	
	/	Data44	101	102	Data43	/	
	/	Data46	103	104	Data45	/	
	/	Data48	105	106	Data47	/	
		GND	107	108	GND		
		NC	109	110	NC		
		NC	111	112	NC		
		NC	113	114	NC		
		NC	115	116	NC		
		GND	117	118	GND		
		GND	119	120	GND		

Note 1. Voltage ranging from 3.3 V to 5.5 V is recommended for input power (VCC).

Note 2. The operating indicator is active-low.

Note 3. OE_RED, OE_GREEN and OE_BLUE are display enabled pins. In the case that OE_RGB are not controlled separately, use OE_RED. When PWM chip is used, GCLK signal is enabled.

Note 4. RFU 1–18 are the reserved pins for extended functions. For details, see 3.4.3 Reference Design for Extended Functions.

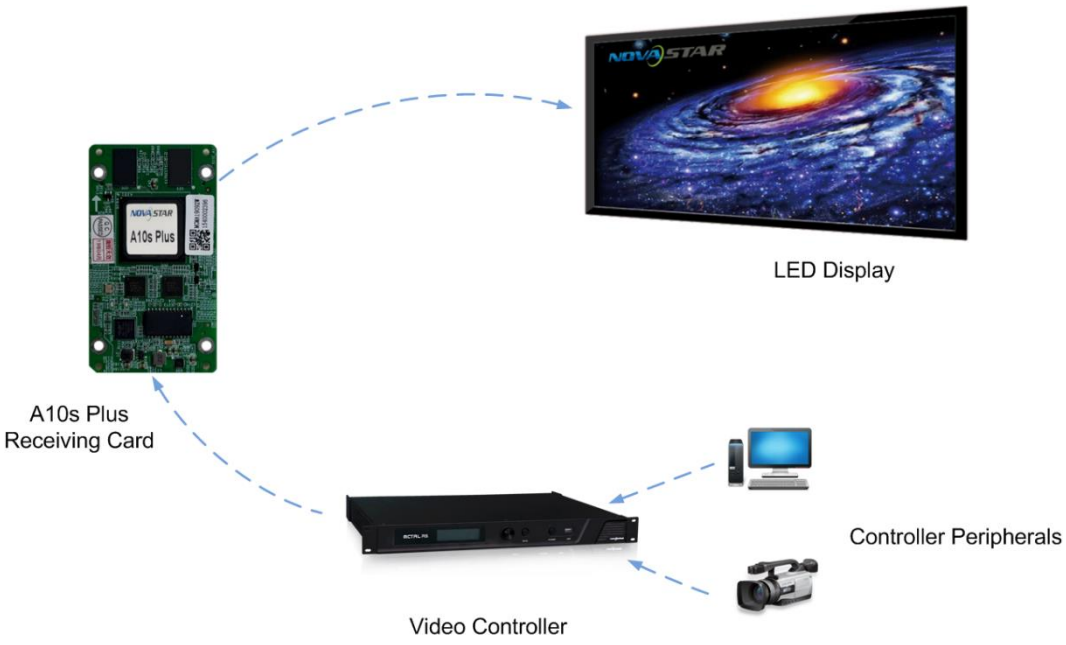
3.4.3 Reference Design for Extended Functions

Description of Pins for Extended Functions			
Extended Pin	Recommended Smart Module Pin	Recommended Module Flash Pin	Description
RFU1	Reserved	Reserved	Reserved pin that connects to MCU
RFU2	Reserved	Reserved	Reserved pin that connects to MCU
RFU3	HUB_CODE0	HUB_CODE0	Flash control pin 1
RFU4	HUB_SPI_CLK	HUB_SPI_CLK	Clock signal of serial pin
RFU5	HUB_CODE1	HUB_CODE1	Flash control pin 2
RFU6	HUB_SPI_CS	HUB_SPI_CS	CS signal of serial pin
RFU7	HUB_CODE2	HUB_CODE2	Flash control pin 3
RFU8	/	HUB_SPI_MOSI	Module Flash storage data input
	HUB_UART_TX	/	TX signal of smart module
RFU9	HUB_CODE3	HUB_CODE3	Flash control pin 4
RFU10	/	HUB_SPI_MISO	Module Flash storage data output
	HUB_UART_RX	/	RX signal of smart module
RFU11	HUB_H164_CSD	HUB_H164_CSD	74HC164 data signal
RFU12	/	/	/
RFU13	HUB_H164_CLK	HUB_H164_CLK	74HC164 clock signal
RFU14	POWER_STA1	POWER_STA1	Dual-power detection signal 1
RFU15	MS_DATA	MS_DATA	Dual-card backup connection signal
RFU16	POWER_STA2	POWER_STA2	Dual-power detection signal 2
RFU17	MS_ID	MS_ID	Dual-card backup identification signal
RFU18	HUB_CODE4	HUB_CODE4	Flash control pin 5

Note: The RFU8 and RFU10 are signal multiplex extension pins. You can select only one pin from either the **Recommended Smart Module Pin** or the **Recommended Module Flash Pin** at the same time.

4 Applications

A10s Plus can be used for LED display synchronous system which is generally composed of LED display, HUB board, receiving card, video controller and controller peripherals. The receiving card is connected to the display over a HUB board. Structure of the synchronous system is as shown in the following figure.



5 Specifications

Maximum Loading Capacity	512×512 pixels	
Electrical Parameters	Input voltage	DC 3.3 V– 5.5 V
	Rated current	0.5 A
	Rated power consumption	2.5 W
Operating Environment	Temperature	-20°C–70°C
	Humidity	10% RH–90% RH, non-condensing
Storage Environment	Temperature	-25°C–125°C
	Humidity	10% RH–90% RH, non-condensing
Packing Information	Packing specifications	An antistatic bag and anti-collision foam are provided for each receiving card. Each packing box contains 40 receiving cards.
	Packing box dimensions	378.0 mm × 190.0 mm × 120.0 mm
Dimensions	80.0 mm × 45.0 mm ×7.3 mm	
Net Weight	22.3 g	
Certifications	RoHS, EMC Class B	

A Acronyms and Abbreviations

E	
EMC	Electromagnetic Compatibility
F	
FPGA	Field-Programmable Gate Array
L	
LED	Light Emitting Diode
M	
MCU	Microcontroller Unit
R	
RCFG	Receiving Card Configuration

B Terms

18Bit+

18Bit+ is a grayscale level of LED display. Activation of 18Bit+ mode in NovaLCT can improve LED display grayscale by 4 times, avoiding grayscale loss due to low brightness and allowing for a finer image.

ClearView

ClearView is a display effect of LED display. Enable ClearView in NovaLCT to make texture, size, and contrast adjustments on different areas of the display based on the Human Visual System, creating a more realistic image.

Calibration coefficient

Calibration coefficients are a group of values, including brightness and chroma information, etc., generated for each LED after the LEDs are calibrated by calibration system.

Smart module

The smart module is composed of Flash and MCU.

Flash can store calibration coefficients and module information. MCU can communicate with the receiving card to monitor temperature, voltage and ribbon cable communication status for the module. Working with the driver chip, MCU also supports open circuit detection of LED.

The smart module allows for a smaller monitoring unit, requiring no independent monitoring card and saving cabinet space.

Mapping

After enabling the Mapping function in NovaLCT, target cabinet will display the receiving card number and Ethernet port information, allowing user to view the receiving card’s location and wiring route.