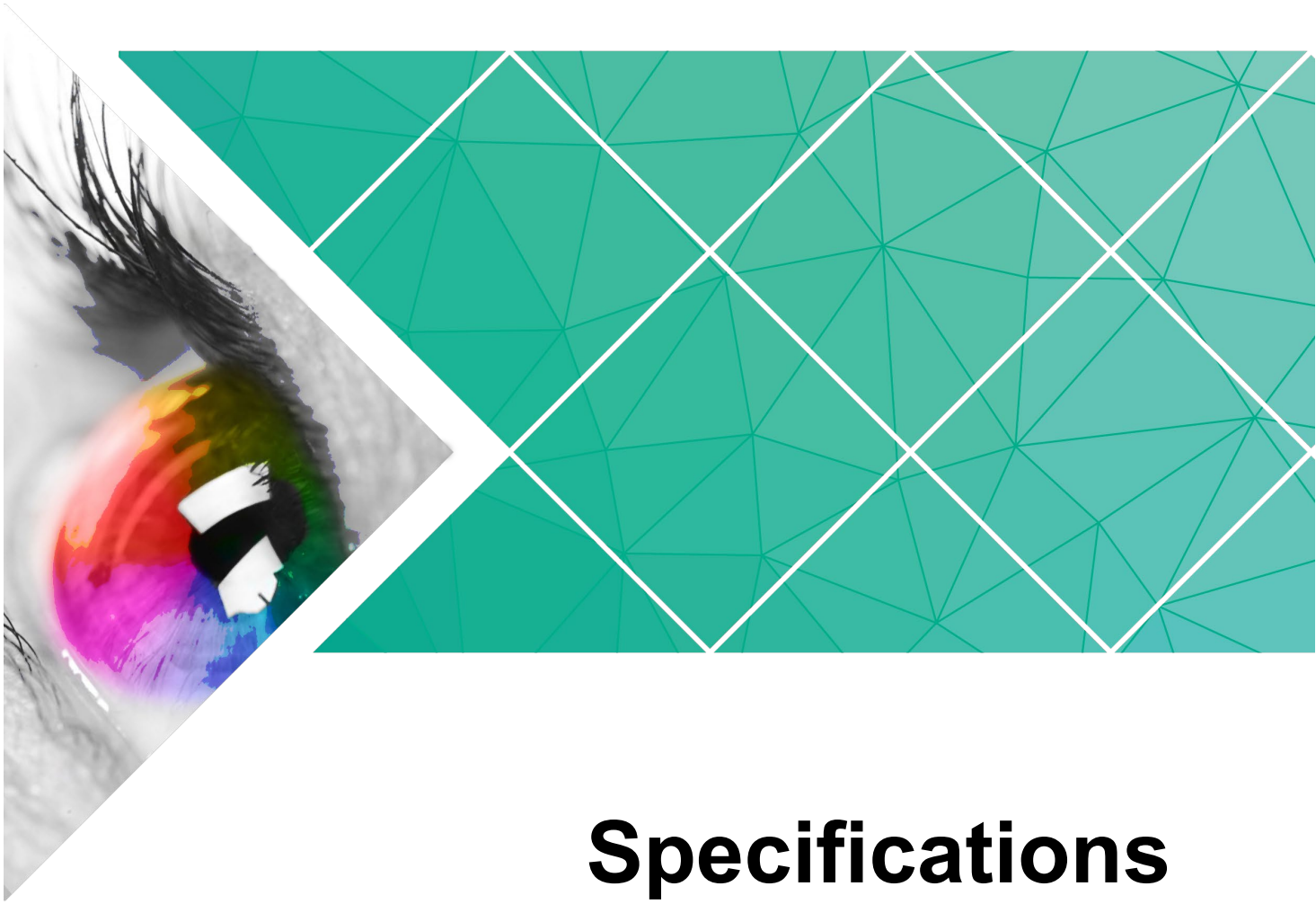
A5s

Receiving Card



Specifications

Document Version: V2.0.0

Document Number: NS110100717

Trademark

NOVASTAR is a trademark of Xi'an NovaStar Tech Co., Ltd.

Statement

You are welcome to use the product of Xi'an NovaStar Tech Co., Ltd. (hereinafter referred to as NovaStar). This document is intended to help you understand and use the product. For accuracy and reliability, NovaStar may make improvements and/or changes to this document at any time and without notice. If you experience any problems in use or have any suggestions, please contact us via contact info given in document. We will do our best to solve any issues, as well as evaluate and implement any suggestions.

Change History

Document Version	Firmware Version	Release Date	Description
V2.0.0	V4.6.0	2019-03-15	• New features – Extension of 128 serial data groups – Individual Gamma adjustment for RGB – Bit error detection • Optimization – Module scan up to 1/64 scan – Cabinet LCD backlight control and run time reset
V1.2.0	V4.5.0	2018-08-10	Optimized the quick seam correction function.
V1.1.0	N/A	2018-01-25	Added the following functions: • LVDS transmission (Supported by dedicated firmware program). • Image rotation in 90° increments.
V1.0.1	N/A	2017-07-27	Optimized the data interface information.
V1.0.0	N/A	2016-10-25	First release

Contents

1 Overview

A5s is a high-end receiving card developed by NovaStar, featuring small size and large loading capacity with a single card loading up to 320×256 pixels (8-bit)/256×256 (10-bit/12-bit). It supports up to 32 parallel data groups and 128 serial data groups.

A5s supports pixel level brightness and chroma calibration by working with NovaLCT and NovaCLB to realize calibration on each pixel. It can effectively remove color difference and greatly improve LED display image consistency, presenting smoother images to users. In addition, it also supports image rotation in 90° increments, creating richer images and improving visual experiences.

Software and hardware designs of the A5s concern the user deployment as well as operating and maintenance scenarios, enabling easier deployment, more stable operating and more efficient maintenance.

Advanced Hardware Design

- The small-size hardware design saves cabinet space and is suitable for a variety of application scenarios.
- Use high-density connector which is resistant to dust and vibration and features high stability and high reliability.
- Assembly network transformer features simple design and improved magnetic compatibility.

Useful Software Design

- Support for up to 1/64 scan.
- Support for extension of 128 serial data groups.
- Support for the following functions by working with NovaLCT (V5.2.0 or later):
  - Random order scanning
  - Lighting modules with extracting channels
  - Individual Gamma adjustment for RGB
  - Bit error detection
- Support for LVDS transmission (Supported by dedicated firmware program).
- Support for smart module (Supported by dedicated firmware program).
- Support for quick seam correction.

- Support for 3D function.
- Support for auto module calibration.
- Support for Mapping function.
- Support for pre-stored image setting of the receiving card.
- Support for module Flash management.
- Supports monitoring voltage and temperature of itself without using other peripherals.
- Support for monitoring of Ethernet cable communication status.
- Support for 5-pin LCD module.
- Support for image rotation in 90° increments.

2 Features

2.1 Improvement in Display Effect

Features	Description
Supports individual Gamma adjustment for RGB	A5s can work with the independent controllers and NovaLCT (V5.2.0 or later) which support individual Gamma adjustment for RGB to effectively control problems such as image non-uniformity under low grayscale and white balance offset by adjusting red Gamma, green Gamma and blue Gamma respectively, making image more real.
Supports pixel level brightness and chroma calibration	Working with NovaLCT and NovaCLB, A5s supports brightness and chroma calibration on each pixel.
Supports image rotation in 90° increments (Calibration not supported after rotation)	On NovaLCT, the image on the screen can be set to rotate in the multiples of 90° (0°, 90°, 180°, and 270°).
Supports quick seam correction	Working with NovaLCT, A5s supports quick adjustment of bright and dark lines, which can remove the seams between modules and between cabinets.
Supports 3D function	On NovaLCT or operation panel of controllers which support 3D function, you can enable 3D function and set the 3D parameters to make the LED screen display 3D effects.

2.2 Improvement in Maintainability

Features	Description
Supports the smart module (Supported by dedicated	The smart module is composed of Flash and MCU. Flash can store calibration coefficients and module

Features	Description
firmware program)	information. MCU can communicate with the receiving card to realize monitoring over temperature, voltage and wiring communication status for the module. Working with the driver chip, A5s supports open circuit detection on LED. The smart module can make monitoring unit smaller, requiring no independent monitoring card and saving cabinet space.
Supports 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 receiving card's HUB board to the module, increases the transmission distance, improves the signal transmission quality, enhances the electromagnetic compatibility (EMC), and better stabilizes the image output.
Supports module auto calibration	After the target module (with module flash) is replaced, the receiving card, when powered on, can automatically read the new module ID and calibration coefficients which will be saved to the receiving card.
Supports Mapping function	Enable the Mapping function on NovaLCT, then the target cabinet will display the cabinet number and Ethernet port information, and the user can easily get the receiving card’s location and data flow.
Supports setting of images pre-stored of the receiving card	On NovaLCT, the specified images can be set as the screen startup image and images used when the Ethernet cable is disconnected or no video source signal is available.
Supports module Flash management	On NovaLCT, lamp panel Flash can be managed.
Supports monitoring voltage and temperature of itself	The voltage and temperature of the receiving card itself can be monitored without using other peripherals. The monitoring data can be checked on NovaLCT.
Supports LCD module	• 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. • Supports cabinet LCD backlight control by working with NovaLCT (V5.2.0 or later). • Supports cabinet run time reset by working with NovaLCT (V5.2.0 or later).
Support one-click application of calibration	In the event of network outage, hold down the self-test button to read the calibration coefficient in

Features	Description
coefficient in module Flash	module Flash back to the receiving card.

2.3 Improvement in Hardware Reliability

Features	Description
Supports dual-card backup and status monitoring	• In the high-reliability environment, single HUB board can be populated with two A5s receiving cards. In case that the main receiving card fails, the standby one will serve in a timely manner to ensure normal operation of the display. • During dual-card backup, A5s can work with NovaLCT (V5.2.0 or later) to monitor the working statuses of the main card and backup card.
Supports dual-power backup detection	Two power supplies can be simultaneously connected, and operating status of the power supplies can be detected.
Supports loop backup	HUB's Ethernet port improves the reliability for the serial connection of the receiving card through main and standby redundant mechanism. Among the main and standby serial connection lines, if one fails, the other will begin to work to ensure the normal operation of the display.

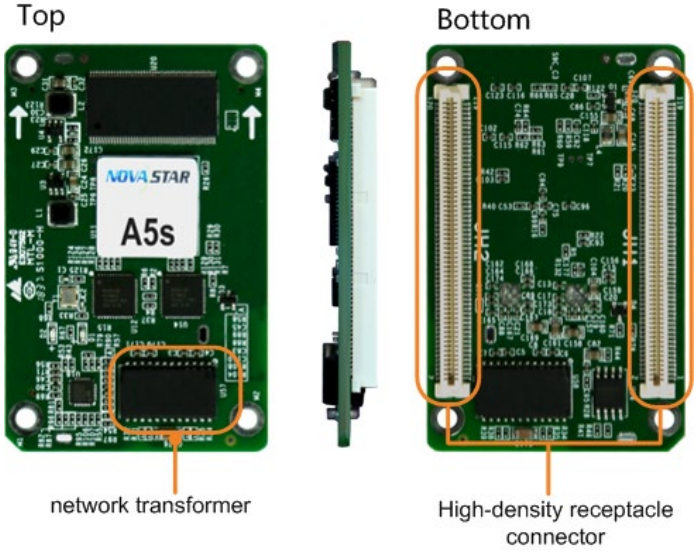
2.4 Improvement in Software Reliability

Features	Description
Supports bit error detection	A5s can work with NovaLCT (V5.2.0 or later) to detect the packet loss of the transmission link during communication between receiving cards.
Supports readback of firmware	On NovaLCT, the firmware of the receiving card can be read back and saved in the local PC.
Supports dual-backup and restoring of the calibration coefficient	Calibration coefficients can be saved in both the factory area and application area at the same time. • Calibration coefficients in the factory area are the factory defaults. • Users can save the calibration coefficients configured by themselves in the user area and can also restore the calibration coefficients in the user area to factory defaults.
Supports backup and readback of receiving card configuration file	• On NovaLCT, the receiving card configuration parameters can be backed up in the receiving card.

Features	Description
	• On NovaLCT, the receiving card configuration parameters can be read back.

3 Hardware

3.1 Appearance



Product images provided in this file are for reference only, and the actual products shall prevail.

Models of the high-density receptacle and plug used by A5s are shown in Table 3-1.

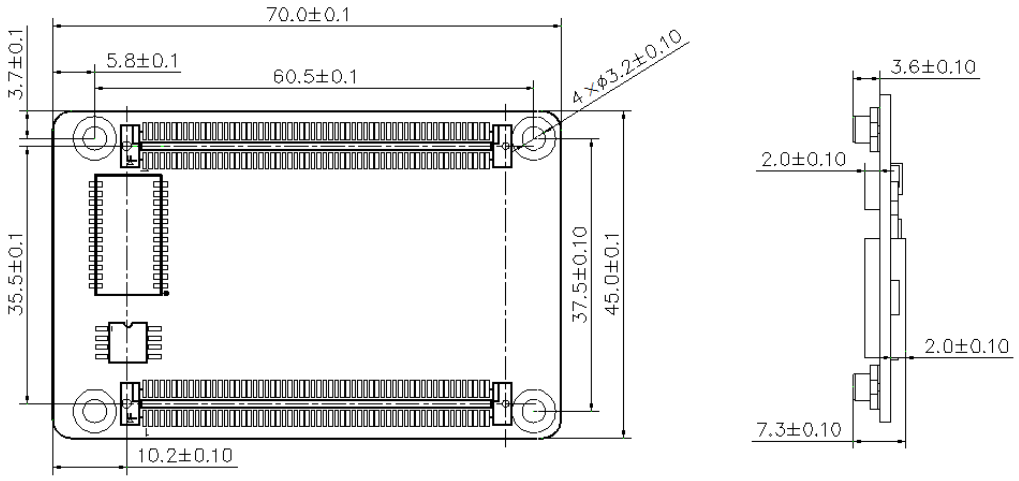
Table 3-1 Model of high-density connector

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

3.2 Dimensions

Board thickness is not greater than 2.0 mm, and the total thickness (board thickness + thickness of both front panel and back panel) is not greater than 7.5 mm.

Unit of the dimension chart is “mm”. Ground connection is enabled for location hole (GND).

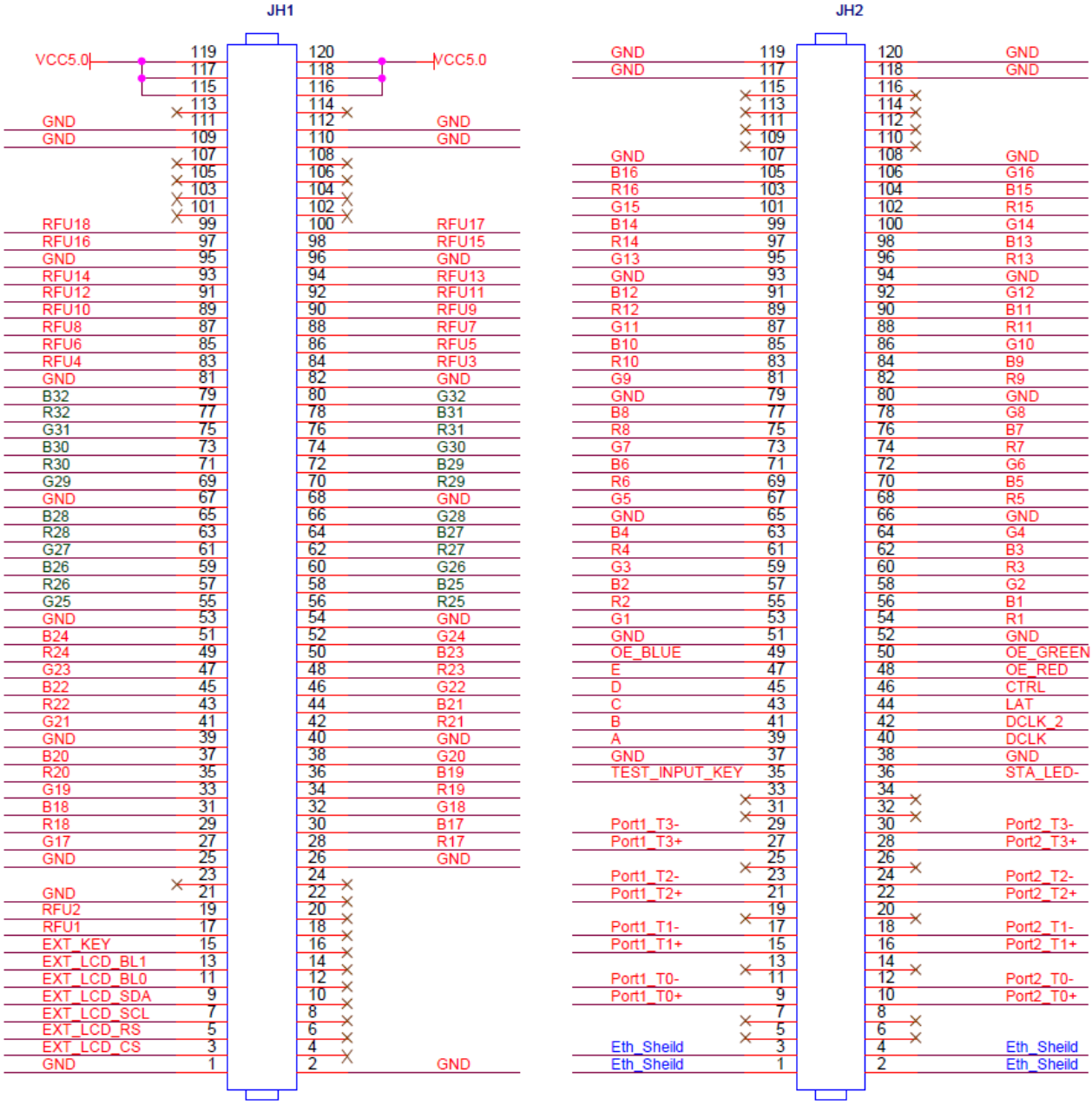


3.3 Indicators

Indicator	Status	Description
Status indicator (green)	Flashing every other 1s.	The receiving card works normally, Ethernet cable connection is normal, and video source input is available.
	Flashing every other 3s.	The receiving card works normally, while the Ethernet cable connection is abnormal.
	Flashing for 3 times every other 3s.	The receiving card works normally, Ethernet cable connection is normal, while no video source input is available.
	Flashing every other 0.5s.	If application area program loading fails in normal operating state, the receiving card will come to the backup operating state.
	Flashing for 8 times every other 1s.	The receiving card is in the Ethernet port backup status and the backup is effective.
Power indicator (red)	Always on	It is always on after the power is on.

3.4 Definition of Data Interface (Top)

3.4.1 32-Group Parallel Data



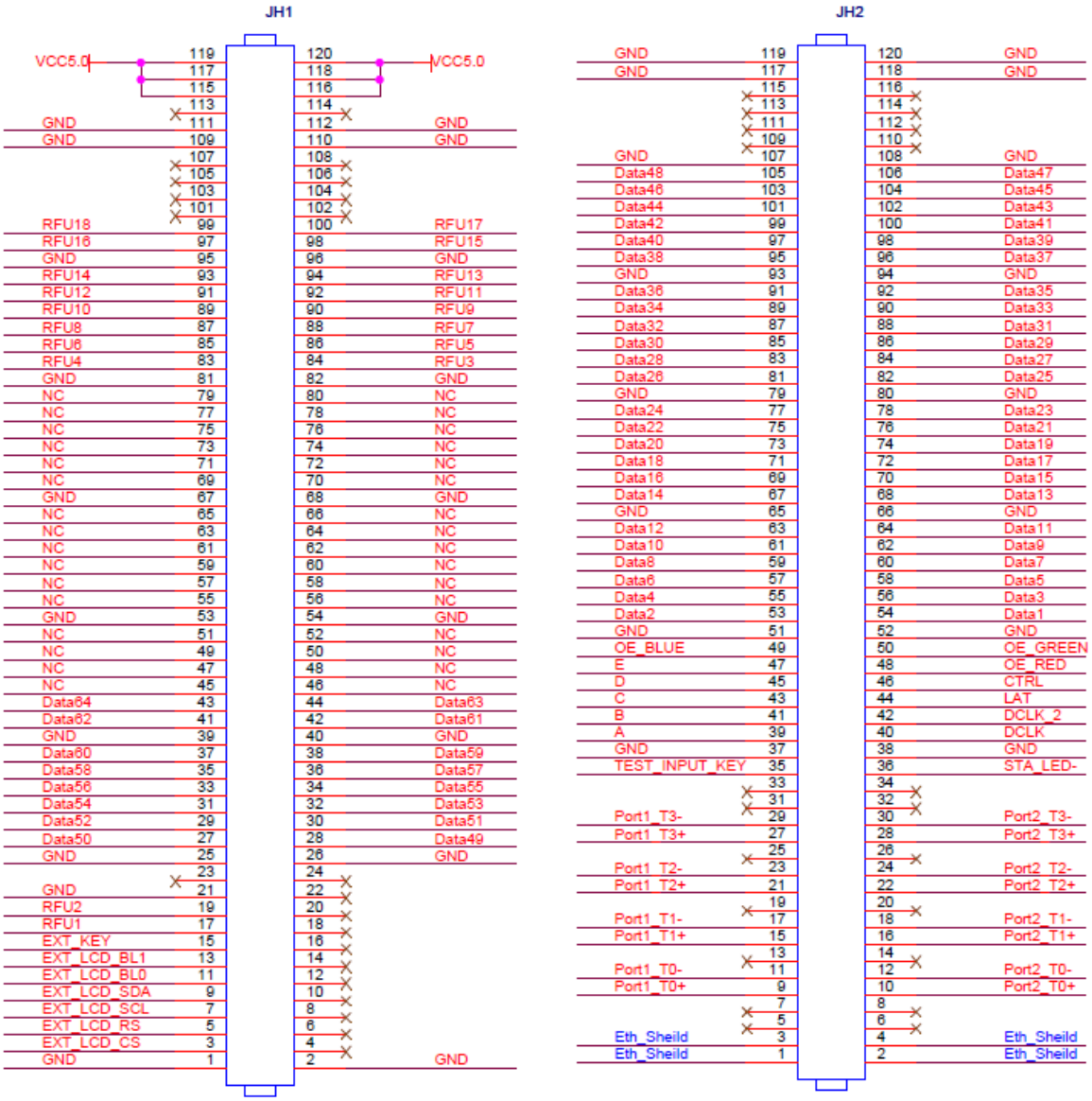
JH1							
		GND	1	2	GND		
LCD	CS signal of LCD	EXT_LCD_CS	3	4	NC		
	RS signal of LCD	EXT_LCD_RS	5	6	NC		
	Clock signal of LCD	EXT_LCD_SCL	7	8	NC		
	Data signal of LCD	EXT_LCD_SDA	9	10	NC		
	Backlight signal 1 of LCD	EXT_LCD_BL0	11	12	NC		

JH1							
	Backlight signal 2 of LCD	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		
	/	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	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							
	Shield grounding	Eth_Shield	1	2	Eth_Shield	Shield grounding	
	Shield grounding	Eth_Shield	3	4	Eth_Shield	Shield grounding	
		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		
	/	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 coding signal	A	39	40	DCLK	Shift clock output in the first route	
	Line coding signal	B	41	42	DCLK_2	Shift clock output in the second route	
	Line coding signal	C	43	44	LAT	Locking of the signal output	
	Line coding signal	D	45	46	CTRL	Afterglow control signal	
	Line coding signal	E	47	48	OE_RED	Display enabled	Note 3
Note 3	Display enabled	OE_BLUE	49	50	OE_GREEN	Display enabled	
		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	100	G14	/	
	/	G15	101	102	R15	/	

JH2							
	/	R16	103	104	B15	/	
	/	B16	105	106	G16	/	
		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		

3.4.2 64-Group Serial Data



JH1							
		GND	1	2	GND		
LCD	CS signal of LCD	EXT_LCD_CS	3	4	NC		
	RS signal of LCD	EXT_LCD_RS	5	6	NC		

JH1							
	Clock signal of LCD	EXT_LCD_SCL	7	8	NC		
	Data signal of	EXT_LCD_SDA	9	10	NC		
	Backlight signal 1 of LCD	EXT_LCD_BL0	11	12	NC		
	Backlight signal 2 of LCD	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	/	
	/	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		

JH1							
Note 1		VCC	115	116	VCC		Note 1
		VCC	117	118	VCC		
		VCC	119	120	VCC		

JH2							
Gigabit Ethernet port	Shield grounding	Eth_Shield	1	2	Eth_Shield	Shield grounding	Gigabit Ethernet port
	Shield grounding	Eth_Shield	3	4	Eth_Shield	Shield grounding	
		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-	/	
		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 coding signal	A	39	40	DCLK	Shift clock output in the first route	
	Line coding signal	B	41	42	DCLK_2	Shift clock output in the second route	
	Line coding signal	C	43	44	LAT	Locking of the signal output	
	Line coding signal	D	45	46	CTRL	Afterglow control signal	
	Line coding signal	E	47	48	OE_RED	Display enabled	Note 3
Note 3	Display enabled	OE_BLUE	49	50	OE_GREEN	Display enabled	
		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	/	

JH2							
	/	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 3.3V to 5.5V is recommended for input power (VCC).

Note 2. Operating indicator that meets low level is valid.

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

Note 4. RFU1–18 are the reserved extended function interfaces. Please refer to "3.4.3 Extended Functions Design".

Note 5. In the 128 groups of serial data set mode, Data65–Data128 reuse the interface data of Data1–Data64 correspondingly.

3.4.3 Extended Functions Design

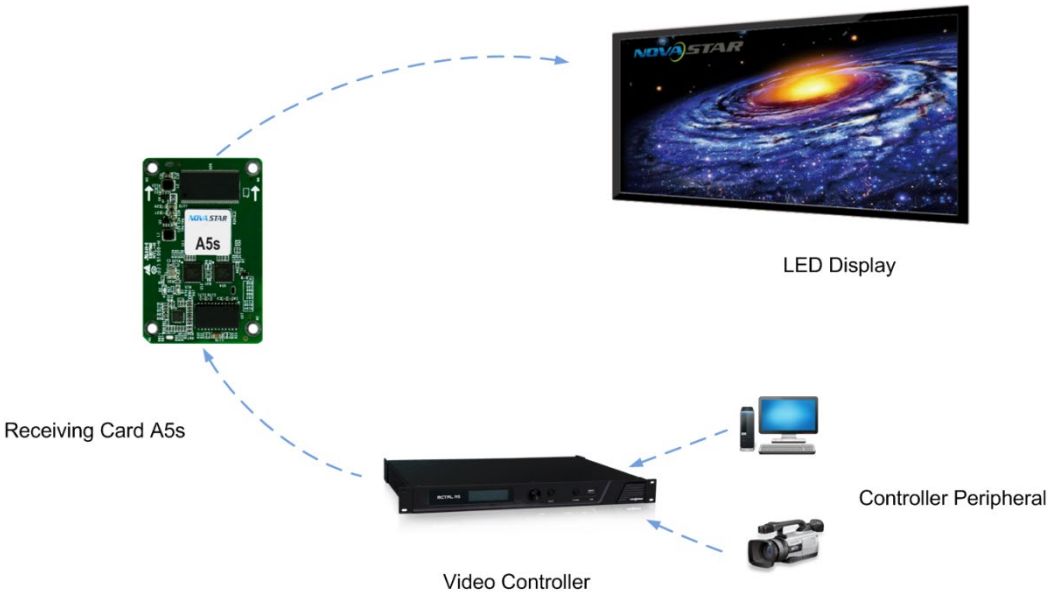
Extended Functions Description			
Expandable Interface	Recommended Smart Module Interface	Recommended Module Flash Interface	Description
RFU1	Reserved	Reserved	Reserved pin that connects to
RFU2	Reserved	Reserved	Reserved pin that connects to
RFU3	HUB_CODE0	HUB_CODE0	Flash control interface 1
RFU4	HUB_SPI_CLK	HUB_SPI_CLK	Clock signal of the serial interface
RFU5	HUB_CODE1	HUB_CODE1	Flash control interface 2
RFU6	HUB_SPI_CS	HUB_SPI_CS	CS signal of the serial interface
RFU7	HUB_CODE2	HUB_CODE2	Flash control interface 3
RFU8	/	HUB_SPI_MOSI	Module Flash storage data input
	HUB_UART_TX	/	TX signal of the smart module
RFU9	HUB_CODE3	HUB_CODE3	Flash control interface 4
RFU10	/	HUB_SPI_MISO	Module Flash storage data output
	HUB_UART_RX	/	RX signal of the 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	1Dual-power detection signal 1

Extended Functions Description			
RFU15	MS_DATA	MS_DATA	Dual-card backup connection signal
RFU16	POWER_STA2	POWER_STA2	2Dual-power detection signal 2
RFU17	MS_ID	MS_ID	Dual-card backup identification signal
RFU18	HUB_CODE4	HUB_CODE4	Flash control interface 5

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

4 Applications

A5s is used for LED display synchronous system which is generally composed of the LED display, HUB board, receiving card, video controller and controller peripheral. 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	320×256 pixels (8-bit) 256×256 pixels (10-bit/12-bit)	
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
Packing Information	Packing specifications	Each card is shipped with an antistatic bag and anti-collision foam. Each box contains 40 cards.
	Packing box dimensions	378.0 mm × 190.0 mm × 120.0 mm
Dimensions	70.0 mm × 45.0 mm × 7.3 mm	
Net Weight	17.3 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

Calibration coefficient

Calibration system generates a group of values for each LED lamp, including information about brightness and chroma. After display calibration, the calibration values of each lamp are just the calibration coefficient.

Smart module

The smart module is composed of Flash and MCU.

Flash can store calibration coefficients and lamp panel information. MCU can communicate with the receiving card to realize monitoring over temperature, voltage and wiring communication status, Working with the driver chip, A5s supports open circuit detection on LED.

The smart module can make monitoring unit smaller, requiring no independent monitoring card and saving cabinet space.

Mapping

After the Mapping function is enabled on NovaLCT, the target cabinet will display the cabinet number and Ethernet port information, and the user can easily get the receiving card’s location and data flow.