A7

Receiving Card

Product Description

Version: V1.0.1

File Number: NS110100357

Trademark

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Change History

Version	Publish Date	Description
V1.0.1	2017-11-06	Changed the loading capacity of receiving card from 320x320 (PWM IC) to 512x256 (PWM IC).
V1.0.0	2017-06-30	The first version

Table of Contents

1 Safety

This chapter illustrates the safety of the A7 receiving card to ensure products' storage, transport, packing and application safety. Safety description is applicable to all personnel that contact or use the products. Pay attention to following points:

- Read throughout the description.
- Save the whole description.
- Be complied with the whole description.

1.1 Storage and Transport Safety

- Pay attention to dust and water prevention.
- Avoid long-term direct sunlight.
- Do not place the products at the position near fire and heat.
- Do not place the products in an area containing explosive materials.
- Do not place the products in strong electromagnetic environment.
- Place the products at a stable position to prevent damage or personal injury caused by dropping.
- Save the packing box and materials which will come in handy if you ever have to ship your products. For maximum protection, repack your product as it was originally packed at the factory.

1.2 Installation and Use Safety

- Only trained professionals may install the products.
- Do not insert and unplug (power cord plug) when the power is on.
- Ensure the safe grounding of the device.
- Always wear a wrist band and insulating gloves.
- Do not place the products in an area having more or strong shake.
- Perform dust removing regularly.
- Do not maintain the products without authorization but contact NovaStar as soon as possible.
- Replace spare parts only with the same parts supplied by NovaStar.

2 Overview

A7 is a high-end receiving card developed by NovaStar, featuring small size and large loading capacity with the single card loading capacity up to 512×256 (PWM IC) pixel.

A7 support for pixel level brightness and chroma calibration which removes color difference effectively, improves display consistency of LED images, and brings finer images for the user. In addition, it also supports image rotation of 90°, 180°, 270° and 360°, creating richer images and improving visual experiences.

Software and hardware designs of the A7 concern the user deployment as well as operating and maintenance scenarios, enabling easier deployment, more stable operating and more efficient maintenance.

Advanced hardware design:

- Small size and thinner thickness save space for increasingly narrower cabinet space and smaller spacing between lamps.
- Employed DDR3 interface could meet requirements of many kinds of electric structures.
- Assembly network transformer features simple design and improved magnetic compatibility, helping user's products to successfully pass the EMC authentication.

Useful software design:

- Support for smart module
- Support for auto module calibration
- Support for Mapping function
- Support for pre-stored image setting of the receiving card
- Support for lamp panel Flash management
- Support for monitoring of temperature, power supply voltage, and Ethernet cable communication status
- Support for 5pin LCD module

3 Characteristics

3.1 Improvement in Display Effect

Characteristics	Description
Supporting pixel level brightness and chroma calibration	Pixel level brightness and chroma calibration on NovaLCT could remove color difference effectively, make the brightness and chroma of the whole screen highly consistent, and improve display effect.
Supporting image rotation (90°, 180°, 270° and 360°)	Image rotation (90°, 180°, 270° and 360°) could be set on the NovaLCT (V5.0.0 and above).

3.2 Improvement in Maintainability

Characteristics	Description
Supporting the smart module	The smart module is composed of Flash and MCU. Flash could store calibration coefficients and lamp panel information. MCU could communicate with the receiving card to realize monitoring over temperature, voltage and wiring communication status, as well as LED error detection. The smart module could make monitoring unit smaller, requiring no independent monitoring card and saving cabinet space.
Supporting module auto calibration	After the lamp panel has been replaced, the receiving card can automatically read the new lamp panel ID and calibration coefficient which could be saved to calibration system files.
Supporting Mapping function	Enable the Mapping function on NovaLCT (V5.0.0 and above), then the target cabinet will display the cabinet number and Ethernet port information, and the user could get the receiving card’s location and wiring route.
Supporting stored image	On NovaLCT, the specified images could be set as

setting of the receiving card	the startup image and images used when there is no network or video source.
Supporting lamp panel Flash management	On NovaLCT, lamp panel Flash could be enabled.
Supporting monitoring over temperature, voltage and wiring status	On NovaLCT, temperature, voltage and wiring status of the receiving card could be checked.
Supporting LCD module	Support NovaStar's product 5pin LCD module which is connected to HUB to display temperature, voltage, single operating time and total operating time of the receiving card.
Support one-click module Flash calibration coefficient	In the event of network outage, hold down the self-test button to read the module Flash calibration coefficient back to the receiving card.

3.3 Improvement in Hardware Reliability

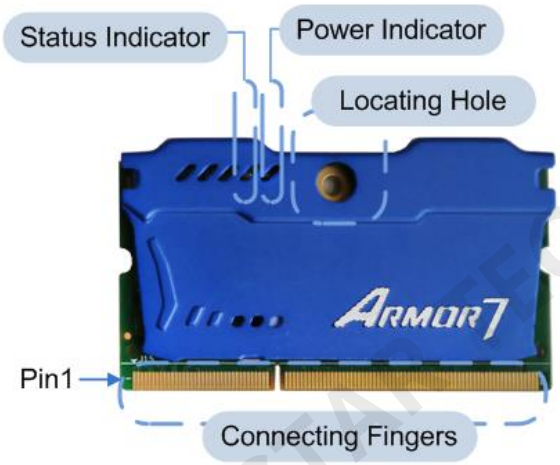
Characteristics	Description
Supporting dual-card backup	In the high-reliability environment, single HUB board could be populated with two A7 receiving cards. In case that the main receiving card fails, the standby one will serve in a timely manner to ensure normal operation of the display.
Supporting dual-power backup & detection	Two power supplies could be simultaneously connected, and operating status of the power supplies could be detected.
Supporting hot backup	Hot backup is used to improve business and connection reliability: ● Device redundant backup: The device connected to the receiving card improves business reliability through main and standby redundant mechanism. Only the main device is running at a certain time. The standby device begins to work to ensure the normal operation of the display while the main device fails. ● Ethernet port redundant 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.

3.4 Improvement in Software Reliability

Characteristics	Description
Supporting firmware read back	Information saved in the receiving card could be read back on the NovaLCT(V5.0.0 and above).
Supporting dual-backup and restoring of the calibration coefficient	Calibration coefficients could be saved to both the factory area and application area at the same time. Calibration coefficients in the factory area is default as the delivery value, while the calibration coefficient in the application area could be modified or be restored to the factory reset by the user on NovaLCT (V5.0.0 and above).
Supporting configuration parameter backup for the receiving card	The user could back up configuration parameters on NovaLCT (V5.0.0 and above).

4 Hardware Structure

4.1 Appearance



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

Models of connecting fingers (DDR3) and receptacle used by A7 are shown in table Figure 4-1.

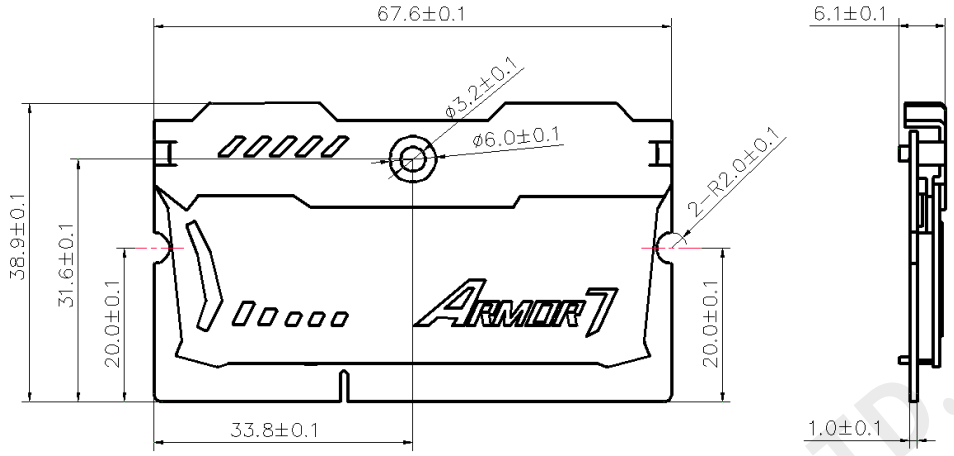
Figure 4-1 Model of connectors

Type	Brand	Material Code
DDR3	/	/
Receptacle	Tyco	2-2013289-1

4.2 Dimensions

Board thickness is not greater than 1.5mm, and the total thickness (board thickness + thickness of both front panel and back panel) is not greater than 6.5mm.

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

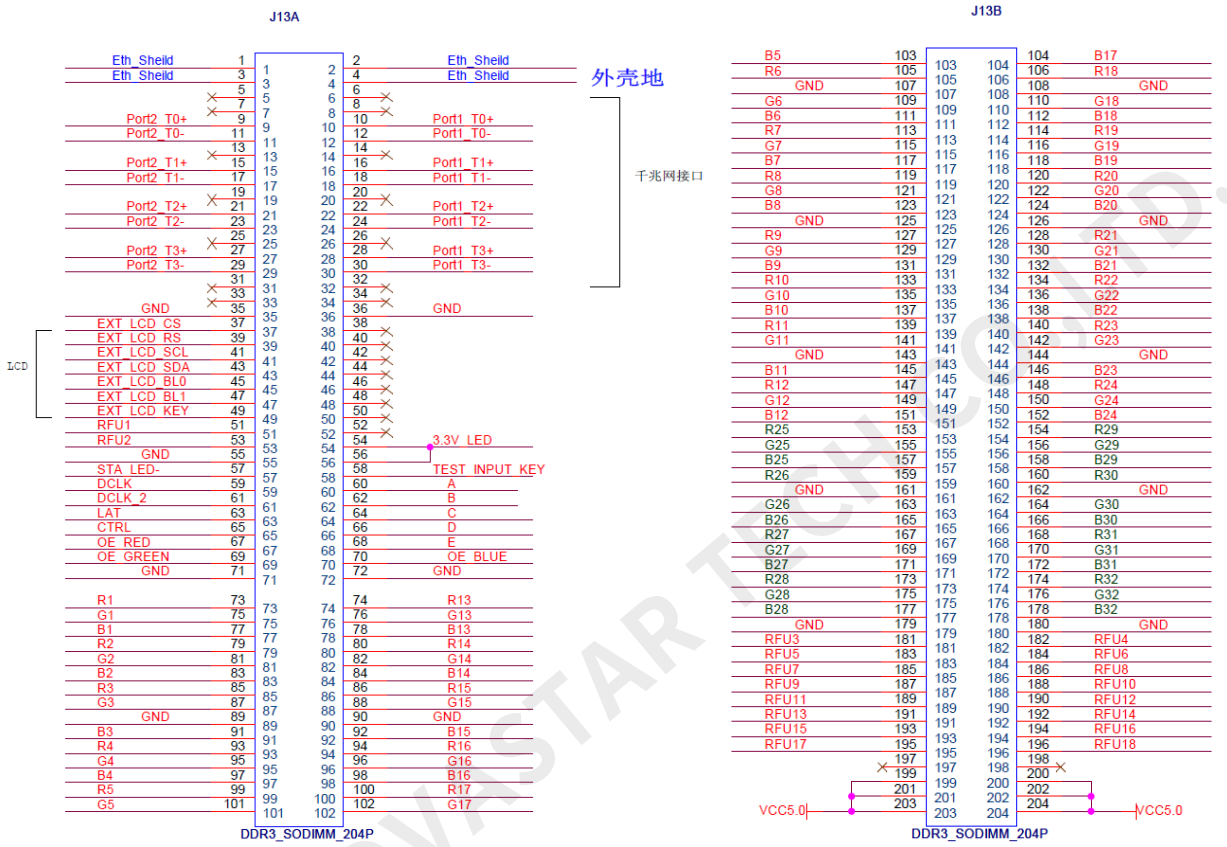


4.3 Indicator

Indicator	Status	Description
Status indicator (green)	Flash every other 1s.	The receiving card works normally, Ethernet cable connection is normal, and video source input is available.
	Flash every other 3s.	The receiving card works normally, while the Ethernet cable connection is abnormal.
	Rapidly flash for 3 times every other 3s.	The receiving card works normally, Ethernet cable connection is normal, while no video source input is available.
	Rapidly flash every other 0.5s.	Program loading fails in normal operating state, coming to the backup operating state.
Status indicator (red)	Remain lit.	It remains lit after the power is on.

4.4 Definition of the Data Interface (Top)

4.4.1 32-Group Parallel Data Interface



J13A							
	Shield grounding	Eth_Shield	1	2	Eth_Shield	Shield grounding	
	Shield grounding	Eth_Shield	3	4	Eth_Shield	Shield grounding	
Gigabit Ethernet port		NC	5	6	NC		Gigabit Ethernet port
		NC	7	8	NC		
	/	Port2_T0+	9	10	Port1_T0+	/	
	/	Port2_T0-	11	12	Port1_T0-	/	
		NC	13	14	NC		
	/	Port2_T1+	15	16	Port1_T1+	/	
	/	Port2_T1-	17	18	Port1_T1-	/	
		NC	19	20	NC		
	/	Port2_T2+	21	22	Port1_T2+	/	
	/	Port2_T2-	23	24	Port1_T2-	/	
		NC	25	26	NC		
	/	Port2_T3+	27	28	Port1_T3+	/	
	/	Port2_T3-	29	30	Port1_T3-	/	
		NC	31	32	NC		
		NC	33	34	NC		
		GND	35	36	GND		
LCD	CS signal of LCD	EXT_LCD_CS	37	38	NC		

	RS signal of LCD	EXT_LCD_RS	39	40	NC		
	Clock signal of LCD	EXT_LCD_SCL	41	42	NC		
	Data signal of LCD	EXT_LCD_SDA	43	44	NC		
	Backlight signal 1 of LCD	EXT_LCD_BL0	45	46	NC		
	Backlight signal 2 of LCD	EXT_LCD_BL1	47	48	NC		
	LCD control button	EXT_LCD_KEY	49	50	NC		
Refer to Note 5.	/	RFU1	51	52	NC		
	/	RFU2	53	54	3.3V_LED	Assist output applies 3.3V power. Refer to Note 6 for applications.	
	/	GND	55	56			
Refer to Note 3.	Operating indicator	STA_LED-	57	58	TEST_INPUT_KEY	Test button	
	Shift clock output in the first route	DCLK	59	60	A	Line coding signal	
	Shift clock output in the second route	DCLK_2	61	62	B	Line coding signal	
	Locking of the signal output	LAT	63	64	C	Line coding signal	
	Afterglow control signal	CTRL	65	66	D	Line coding signal	
Refer to Note 4.	Display enabled	OE_RED	67	68	E	Line coding signal	
	Display enblaed	OE_GREEN	69	70	OE_BLUE	Display enabled	Refer to Note 4.
	/	GND	71	72	GND		
Refer to Note 2.	/	R1	73	74	R13	/	Refer to Note 2.
	/	G1	75	76	G13	/	
	/	B1	77	78	B13	/	
	/	R2	79	80	R14	/	
	/	G2	81	82	G14	/	
	/	B2	83	84	B14	/	
	/	R3	85	86	R15	/	
	/	G3	87	88	G15	/	
		GND	89	90	GND		
Refer to Note 2.	/	B3	91	92	B15	/	Refer to Note 2.
	/	R4	93	94	R16	/	
	/	G4	95	96	G16	/	
	/	B4	97	98	B16	/	
	/	R5	99	100	R17	/	
	/	G5	101	102	G17	/	

J13B							
Refer to Note 2.	/	B5	103	104	B17	/	Refer to Note 2.
	/	R6	105	106	R18	/	
		GND	107	108	GND		
Refer to Note 2.	/	G6	109	110	G18	/	Refer to Note 2.
	/	B6	111	112	B18	/	
	/	R7	113	114	R19	/	
	/	G7	115	116	G19	/	
	/	B7	117	118	B19	/	
	/	R8	119	120	R20	/	
	/	G8	121	122	G20	/	
	/	B8	123	124	B20	/	
		GND	125	126	GND		
Refer to Note 2.	/	R9	127	128	R21	/	Refer to Note 2.
	/	G9	129	130	G21	/	
	/	B9	131	132	B21	/	

	/	R10	133	134	R22	/	
	/	G10	135	136	G22	/	
	/	B10	137	138	B22	/	
	/	R11	139	140	R23	/	
	/	G11	141	142	G23	/	
		GND	143	144	GND		
	/	B11	145	146	B23	/	
	/	R12	147	148	R24	/	
	/	G12	149	150	G24	/	
Refer to Note 2.	/	B12	151	152	B24	/	Refer to Note 2.
	/	R25	153	154	R29	/	
	/	G25	155	156	G29	/	
	/	B25	157	158	B29	/	
	/	R26	159	160	R30	/	
		GND	161	162	GND		
	/	G26	163	164	G30	/	
	/	B26	165	166	B30	/	
	/	R27	167	168	R31	/	
Refer to Note 2.	/	G27	169	170	G31	/	Refer to Note 2.
	/	B27	171	172	B31	/	
	/	R28	173	174	R32	/	
	/	G28	175	176	G32	/	
	/	B28	177	178	B32	/	
		GND	179	180	GND		
	/	RFU3	181	182	RFU4	/	
	/	RFU5	183	184	RFU6	/	
	/	RFU7	185	186	RFU8	/	
Refer to Note 5.	/	RFU9	187	188	RFU10	/	Refer to Note 5.
	/	RFU11	189	190	RFU12	/	
	/	RFU13	191	192	RFU14	/	
	/	RFU15	193	194	RFU16	/	
	/	RFU17	195	196	RFU18	/	
		NC	197	198	NC		
Refer to Note 1.		VCC	199	200	VCC		Refer to Note 1.
		VCC	201	202	VCC		
		VCC	203	204	VCC		

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

Note 2. RGB data groups must be used in group.

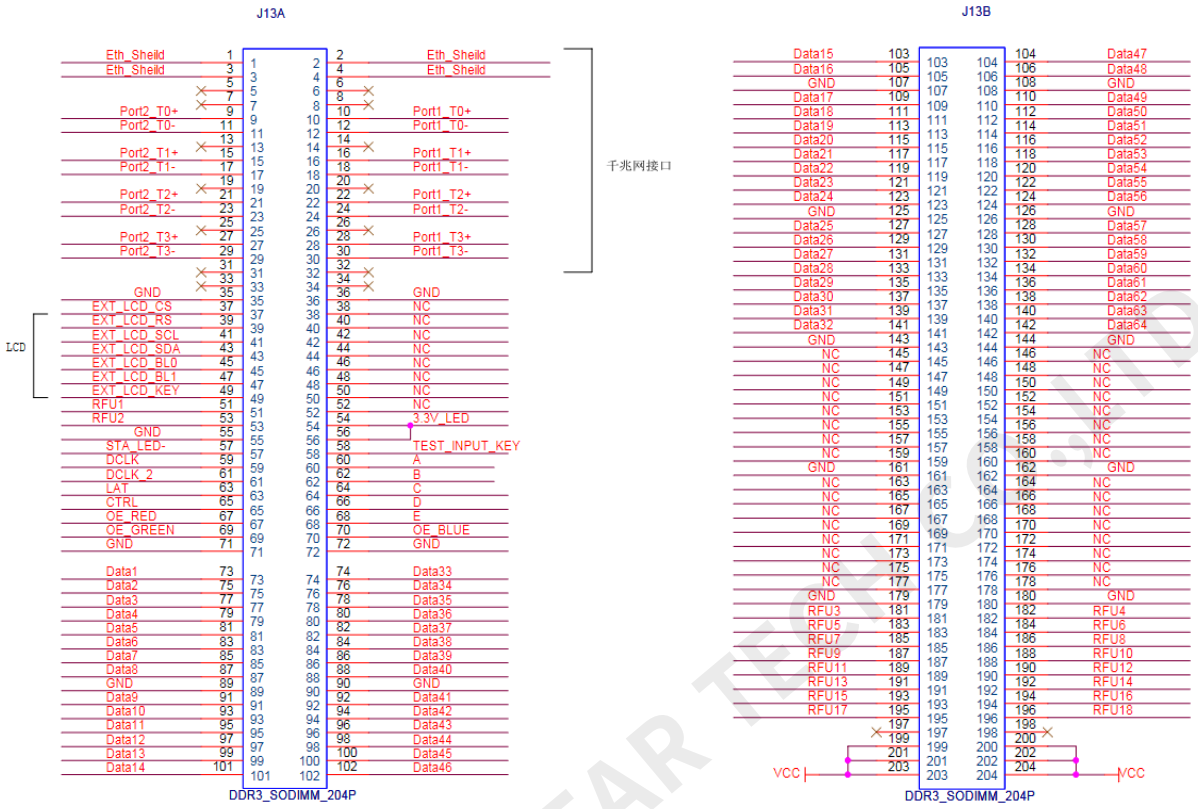
Note 3. Operating indicator that meets low level is valid.

Note 4. OE_RED, OE_GREEN and OE_BLUE are display enabled pins. In case that OE_RGB are not controlled separately, OE_RED signal is applied. When PWM chip is used, GCLK signal is enabled.

Note 5. RFU1 – 18 are the reserved extended function interfaces. Please refer to “4.4.3 Reference Design for Expandable Interfaces”.

Note 6. 3.3V_LEDis only applicable to low current applications including indicator power supply and pull-up resistance, while external 3.3V power supply suits heavy current applications.

4.4.2 64-Group Serial Data Interface



J13A							
	Shield grounding	Eth_Shield	1	2	Eth_Shield	Shield grounding	
	Shield grounding	Eth_Shield	3	4	Eth_Shield	Shield grounding	
Gigabit Ethernet port		NC	5	6	NC		Gigabit Ethernet port
		NC	7	8	NC		
	/	Port2_T0+	9	10	Port1_T0+	/	
	/	Port2_T0-	11	12	Port1_T0-	/	
		NC	13	14	NC		
	/	Port2_T1+	15	16	Port1_T1+	/	
	/	Port2_T1-	17	18	Port1_T1-	/	
		NC	19	20	NC		
	/	Port2_T2+	21	22	Port1_T2+	/	
	/	Port2_T2-	23	24	Port1_T2-	/	
		GND	25	26	GND		
	/	Port2_T3+	27	28	Port1_T3+	/	
	/	Port2_T3-	29	30	Port1_T3-	/	
		NC	31	32	NC		
		NC	33	34	NC		
		GND	35	36	GND		
LCD	CS signal of LCD	EXT_LCD_CS	37	38	NC		
	RS signal of LCD	EXT_LCD_RS	39	40	NC		
	Clock signal of LCD	EXT_LCD_SCL	41	42	NC		
	Data signal of LCD	EXT_LCD_SDA	43	44	NC		
	Backlight signal 1 of LCD	EXT_LCD_BL0	45	46	NC		

	Backlight signal 2 of LCD	EXT_LCD_BL1	47	48	NC		
	LCD control button	EXT_LCD_KEY	49	50	NC		
Refer to Note 11.	/	RFU1	51	52	NC		
	/	RFU2	53	54	3.3V_LED	Auxiliary output applies 3.3V power. Refer to Note 12 for applications.	
	/	GND	55	56			
Refer to Note 9.	Operating indicator	STA_LED-	57	58	TEST_INPUT_KEY	Test button	
	Shift clock output in the first route	DCLK	59	60	A	Line coding signal	
	Shift clock output in the second route	DCLK_2	61	62	B	Line coding signal	
	Locking of the signal output	LAT	63	64	C	Line coding signal	
	Afterglow control signal	CTRL	65	66	D	Line coding signal	
Refer to Note 10.	Display enabled	OE_RED	67	68	E	Line coding signal	
	Display enabled	OE_GREEN	69	70	OE_BLUE	Display enabled	Refer to Note 10.
		GND	71	72	GND		
Refer to Note 8.	/	Data1	73	74	Data33	/	Refer to Note 8.
	/	Data2	75	76	Data34	/	
	/	Data3	77	78	Data35	/	
	/	DatA5	79	80	Data36	/	
	/	Data5	81	82	Data37	/	
	/	Data6	83	84	Data38	/	
	/	Data7	85	86	Data39	/	
	/	Data8	87	88	Data40	/	
		GND	89	90	GND		
Refer to Note 8.	/	Data9	91	92	Data41	/	Refer to Note 8.
	/	Data10	93	94	Data42	/	
	/	Data11	95	96	Data43	/	
	/	Data12	97	98	Data44	/	
	/	Data13	99	100	Data45	/	
	/	Data14	101	102	Data46	/	

J13B							
Refer to Note 8.	/	Data15	103	104	Data47	/	Refer to Note 8.
	/	Data16	105	106	Data48	/	
		GND	107	108	GND		
Refer to Note 8.	/	Data17	109	110	Data49	/	Refer to Note 8.
	/	Data18	111	112	Data50	/	
	/	Data19	113	114	Data51	/	
	/	Data20	115	116	Data52	/	
	/	Data21	117	118	Data53	/	
	/	Data22	119	120	Data54	/	
	/	Data23	121	122	Data55	/	
	/	Data24	123	124	Data56	/	
		GND	125	126	GND		
Refer to Note 8.	/	Data25	127	128	Data57	/	Refer to Note 8.
	/	Data26	129	130	Data58	/	
	/	Data27	131	132	Data59	/	
	/	Data28	133	134	Data60	/	

	/	Data29	135	136	Data61	/	
	/	Data30	137	138	Data62	/	
	/	Data31	139	140	Data63	/	
	/	Data32	141	142	Data64	/	
		GND	143	144	GND		
		NC	145	146	NC		
		NC	147	148	NC		
		NC	149	150	NC		
		NC	151	152	NC		
		NC	153	154	NC		
		NC	155	156	NC		
		NC	157	158	NC		
		NC	159	160	NC		
		GND	161	162	GND		
		NC	163	164	NC		
		NC	165	166	NC		
		NC	167	168	NC		
		NC	169	170	NC		
		NC	171	172	NC		
		NC	173	174	NC		
		NC	175	176	NC		
		NC	177	178	NC		
		GND	179	180	GND		
Refer to Note 11.	/	RFU3	181	182	RFU4	/	Refer to Note 11.
	/	RFU5	183	184	RFU6	/	
	/	RFU7	185	186	RFU8	/	
	/	RFU9	187	188	RFU10	/	
	/	RFU11	189	190	RFU12	/	
	/	RFU13	191	192	RFU14	/	
	/	RFU15	193	194	RFU16	/	
	/	RFU17	195	196	RFU18	/	
		NC	197	198	NC		
Refer to Note 7.		VCC	199	200	VCC		Refer to Note 7.
		VCC	201	202	VCC		
		VCC	203	204	VCC		

Note 7. Voltage ranging from 3.3V to 5.5V is recommended for input power (VCC).

Note 8. RGB data groups must be used in group.

Note 9. Operating indicator that meets low level is valid.

Note 10. OE_RED, OE_GREEN and OE_BLUE are display enabled pins. In case thatOE_RGB are not controlled separately, OE_RED is applied. While PWM chip is used, GCLK signal is enabled.

Note 11. RFU1 – 18 are the reserved extended function interfaces. Please refer to “4.4.3 Reference Design for Expandable Interfaces”.

Note 12. 3.3V_LED is only applicable to low current applications including indicator power supply and pull-up resistance, while external 3.3V power supply suits heavy current applications.

4.4.3 Reference Design for Expandable Interfaces

Expandable Interfaces			
Expandable Interface	Recommended Smart Module Interface	Recommended Module Flash Interface	Description
RFU1	/	/	/
RFU2	/	/	/
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	Flash storage data input of the lamp panel
	HUB_UART_TX	/	TX signal of the smart module
RFU9	HUB_CODE3	HUB_CODE3	Flash control interface 4
RFU10	/	HUB_SPI_MISO	Flash storage data output of the lamp panel
	HUB_UART_RX	/	RX signal of the smart module
RFU11	HUB_H164_CSD	HUB_H164_CSD	74HC164 data signal
RFU12	POWER_STA1	POWER_STA1	1Dual-power detection signal 1
RFU13	HUB_H164_CLK	HUB_H164_CLK	74HC164 Clock signal
RFU14	POWER_STA2	POWER_STA2	2Dual-power detection signal 2
RFU15	MS_ID	MS_ID	Dual-card backup identification signal
RFU16	/	/	/
RFU17	MS_DATA	MS_DATA	Dual-card backup connection signal
RFU18	/	/	/

Description:

RFU8 and RFU10 are signal multiplexing expandable interfaces for which the interfaces of either **Recommended Smart Module Interface** or **Recommended Module Flash Interface** can be enabled in one operation.

5 Software Structure

A7 delivery firmware includes MCU program and FPGA program.

Program download method:

Please visit www.novastar.tech, and select “Download Center > Software and Data”. Click on “Program Software” in “Receiving Card” area to enter the download list and acquire the required program package.

6 Typical Networking

A7 is applied to LED display synchronous system which is generally composed of the LED display, HUB board, receiving card, LED display controller and peripherals. The receiving card is connected to the display over a HUB board.

Synchronous system requires connecting a computer to display the computer's images and texts on the LED screen. Structure of the synchronous system is as shown in the following figure.

7 Specifications

Input voltage	DC 3.3V-5.5V
Rated current	0.5A
Rated power consumption	2.5W
Operating temperature	-20ºC-70ºC
Operating humidity	0%～90%
Dimension	67.6mm×38.9mm×6.1mm
Net weight	9.9g
Authentication	• Pass the EMC Class B authentication. • Pass the RoHS authentication.
Packing	The antistatic bag and anti-collision foam are prepared for each receiving card. Dimension of the packing box: 378mm×190mm×120mm, each of 40 receiving cards.

A Abbreviation

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 could store calibration coefficients and lamp panel information. MCU could communicate with the receiving card to realize monitoring over temperature, voltage and wiring communication status, as well as LED error detection.

The smart module could 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 could get the receiving card's location and wiring route.

Error detection

Perform status detection for each LED lamp. If the LED lamp fails, the user could notify in a timely manner upon monitoring system.