User's Manual

RA Family

Application Board for RA8 Microcontroller Series
Parallel Graphics Expansion Board 1 v1
User's Manual

Renesas RA Family

RA8 Series

Renesas Electronics
www.renesas.com

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1. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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Precautions

This Application Board is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

• Ensure attached cables do not lie across the equipment.

• Reorient the receiving antenna.

• Increase the distance between the equipment and the receiver.

• Connect the equipment into an outlet on a circuit different from that which the receiver is connected.

• Power down the equipment when not in use.

• Consult the dealer or an experienced radio/TV technician for help.

Note: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

• The user is advised that mobile phones should not be used within 10 m of the product when in use.

• The user is advised to take ESD precautions when handling the equipment.

The Application Board does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Renesas RA Family

Parallel Graphics Expansion Board 1 v1

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1. Kit Overview

The Parallel Graphics Expansion Board 1 Application Kit for RA8 MCU Series enables users to add LCD functionality using an RGB parallel digital interface to seamlessly evaluate the features of the RA8 MCU Series. With a programmable evaluation kit such as the EK-RA8P1 or EK-RA8D2, users can develop embedded systems applications using Flexible Software Package (FSP) and e^2 studio IDE. Whilst designed for the RA8 MCU Series, this application board can be applied to any evaluation board with the correct peripheral output and compatible Parallel Graphics Expansion Port.

The key features of the Parallel Graphics Expansion Board 1 are as follows:

Key Features:

- Adds LCD Functionality to Evaluation Kits via a 24-bit RGB Interface
- 1024 × 600 pixel 7-Inch TFT Display (ER-TFT070-6) fitted with Capacitive Touch Panel and controller (ER-TPC070-6)
- Compatible with the EK-RA8P1 and EK-RA8D2

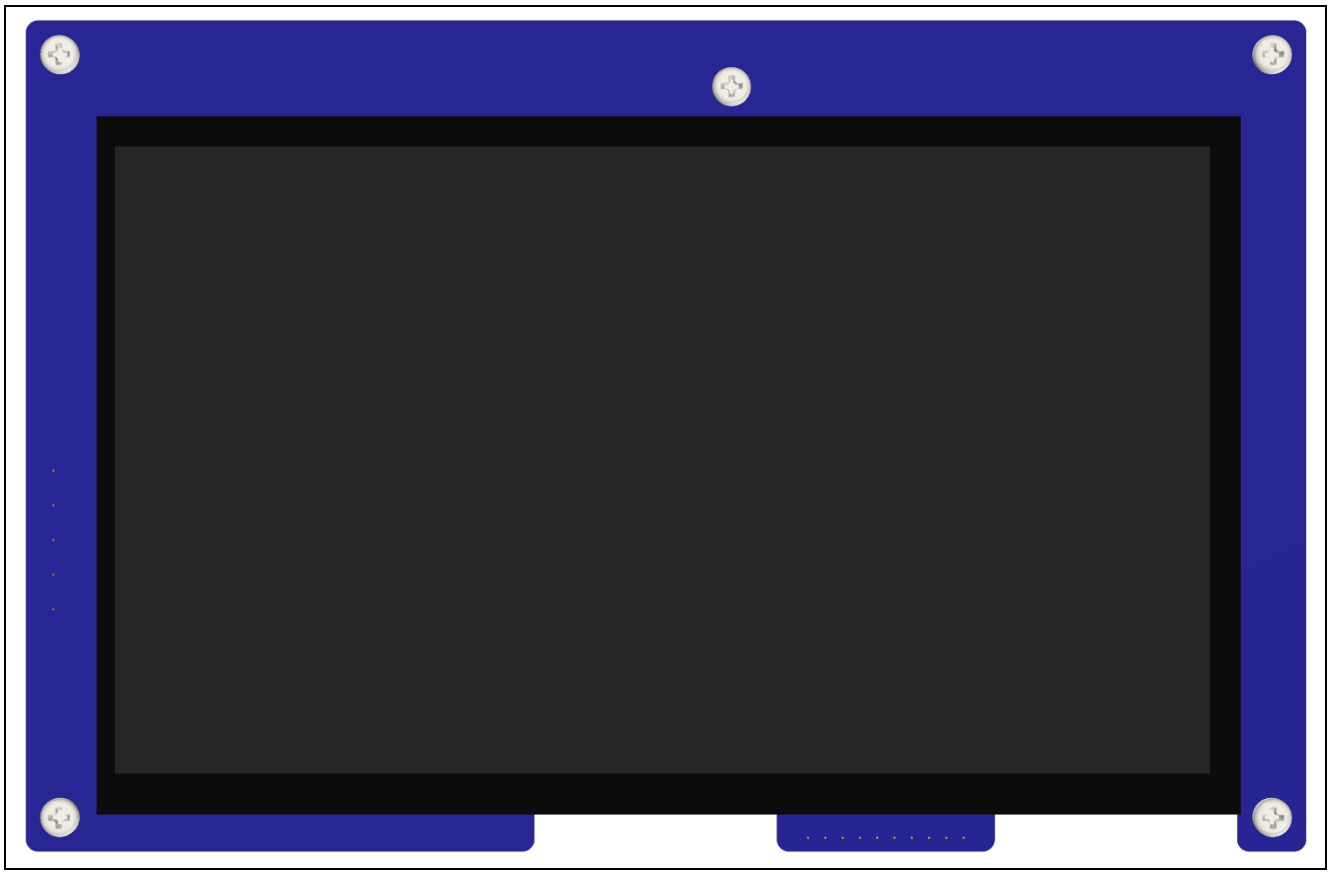

Figure 1. Parallel Graphics Expansion Board 1 Top Side

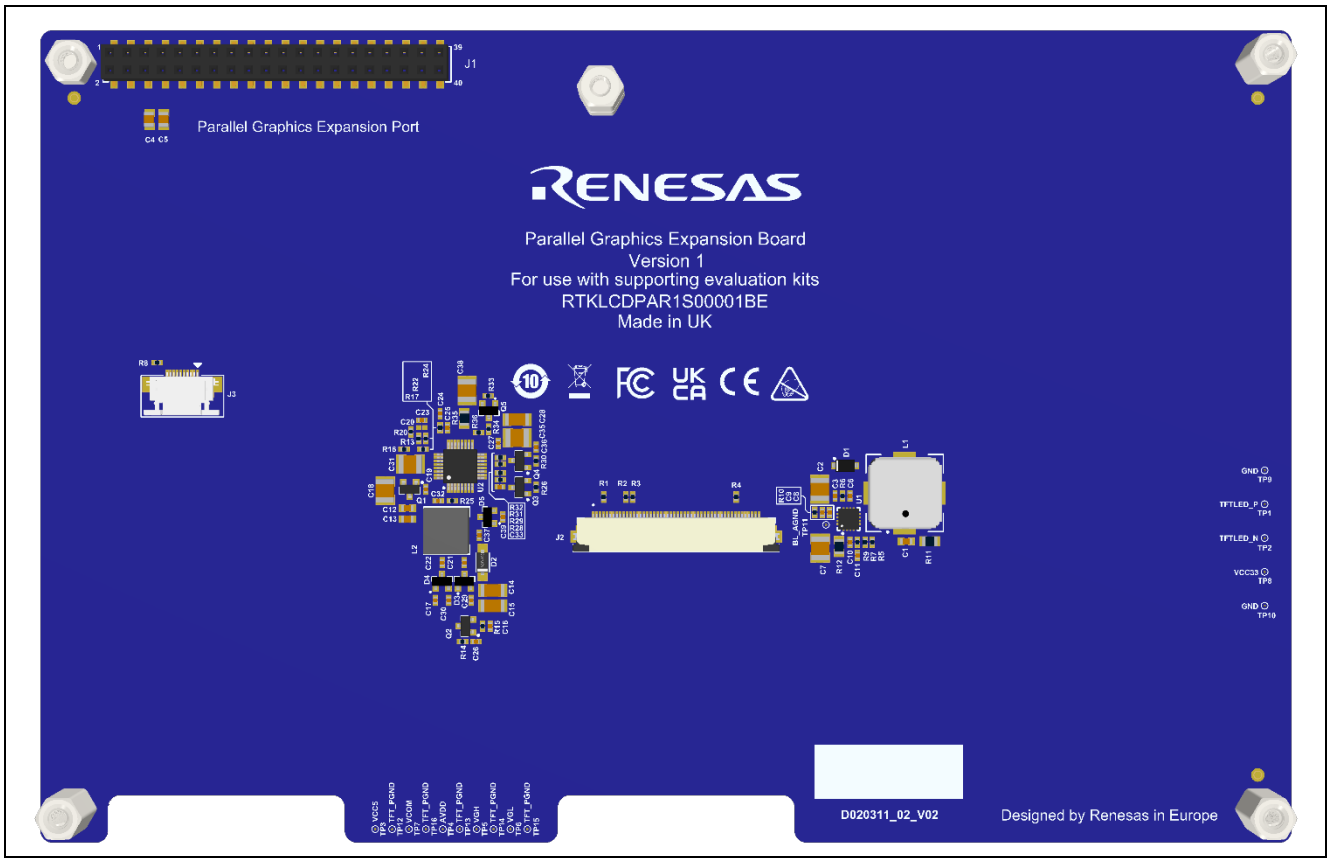

Figure 2. Parallel Graphics Expansion Board 1 Bottom Side

1.1 Assumptions and Advisory Notes

1. It is assumed that the user has a basic understanding of microcontrollers and embedded systems hardware.
2. Flexible Software Package (FSP) and an Integrated Development Environment (IDE) such as e^2 studio are required to develop embedded applications that apply to the Parallel Graphics Expansion Board 1.
3. It is assumed the user has an RA8P1, RA8D2 or similar MCU to add LCD functionality to, this board cannot be programmed directly.
4. It is recommended that the user refers to the Quick Start Example Project that the EK-RA8P1 and EK-RA8D2 board comes pre-programmed with.
5. Instructions to download and install software, import example projects, build them and program the EK-RA8P1 and EK-RA8D2 boards are provided in their respective Quick Start Guide.

2. Kit Contents

The following components are included in the kit.

1. Parallel Graphics Expansion Board 1 v1 fitted with a 1024 x 600 pixel 7-Inch TFT Display
2. Display mounting hardware (spacers and fixing screws)

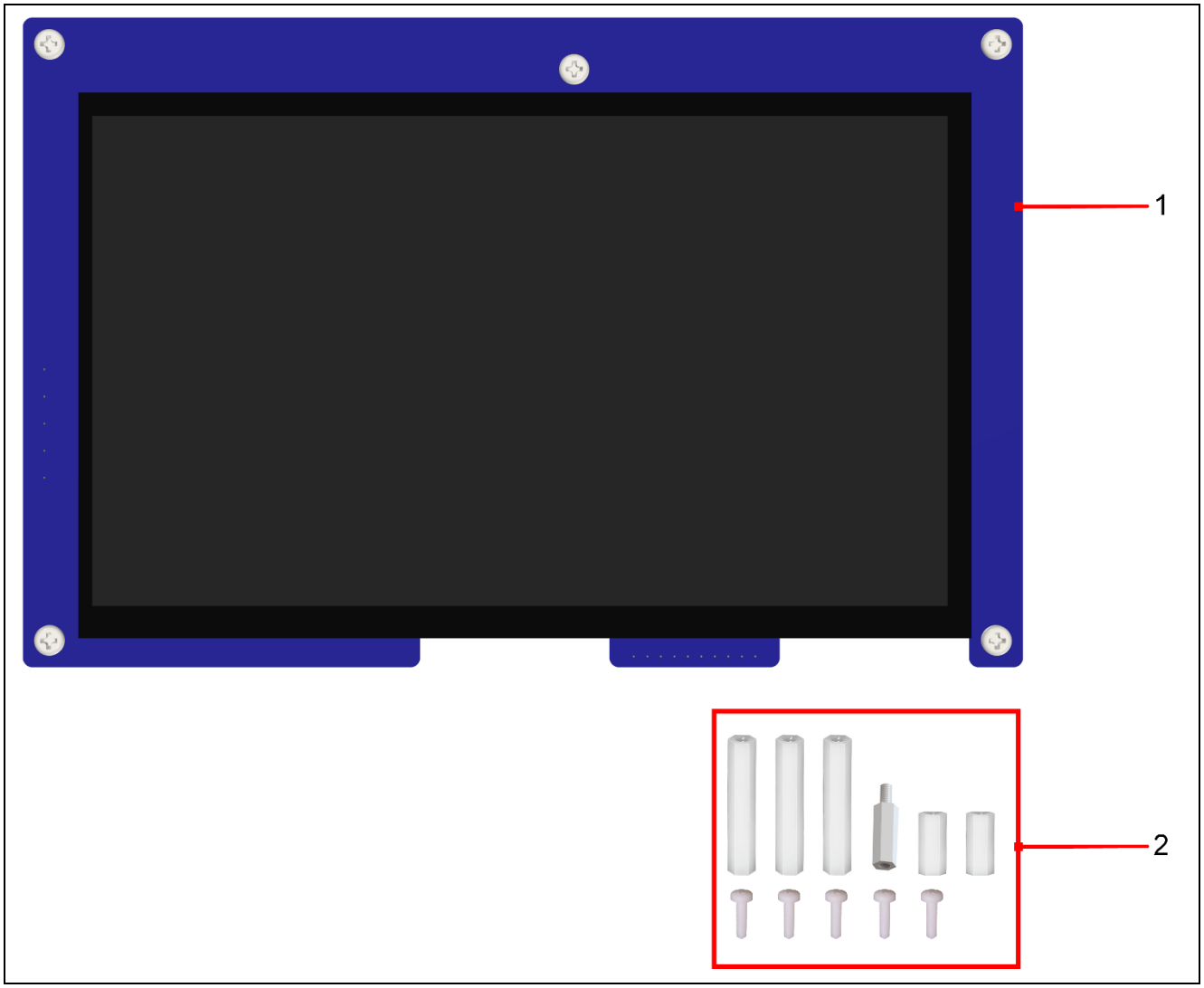

Figure 3. Parallel Graphics Expansion Board 1 Kit Contents

3. Ordering Information

- Parallel Graphics Expansion Board 1 v1 kit orderable part number: RTKLCDPAR1S0000**1**BE

Note: The underlined character in the orderable part number represents the kit version.

Dimensions: 185 mm (length) x 120 mm (width)

4. Connectivity

4.1 Parallel Graphics Expansion Port (J1)

The Parallel Graphics Expansion Board 1 hosts a 7-inch 1024 x 600 TFT LCD with a capacitive touchscreen. The Parallel Graphics Expansion Board 1 can be connected to compatible evaluation kits via the 40-pin Socket Parallel Graphics Expansion Port (J1).

Table 1. Parallel Graphics Expansion Port (J1)

J1 Pin	Signal Description	Test Point
1	BLEN	-
2	SDA	-
3	INT_L	-
4	SCL	-
5	VCC33	TP8
6	RESET_L	-
7	VCC33	TP8
8	VCC5	TP3
9	VSYNC	-
10	EXTCLK	-
11	DE	-
12	HSYNC	-
13	NC	-
14	NC	-
15	B1	-
16	B0	-
17	B3	-
18	B2	-
19	B5	-
20	B4	-
21	B7	-
22	B6	-
23	G1	-
24	G0	-
25	G3	-
26	G2	-
27	G5	-
28	G4	-
29	G7	-
30	G6	-
31	R1	-
32	R0	-
33	R3	-
34	R2	-
35	R5	-
36	R4	-
37	R7	-
38	R6	-
39	GND	TP9 and TP10
40	GND	

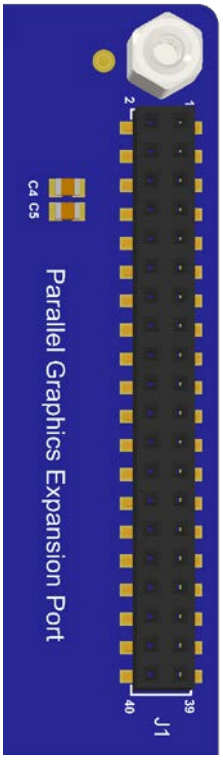

Figure 4. Parallel Graphics Expansion Port

4.2 FPC Connector for LCD Data (J2)

The TFT LCD peripheral, data and power lines connect to the Parallel Graphics Expansion Board 1 via the 50-pin FPC connector (J2).

Table 2. FPC Connector for LCD Data (J2)

J2 Pin	Signal Description	LCD Panel Pin	LCD Signal Description	Test Point
50	LEDA	1	LED_A	TP1
49		2		
48	LEDK	3	LED_K	TP2
47		4		
46	GND	5	GND	*
45	VCOM	6	VCOM	TP7
44	VCC33	7	DVDD	TP8
43		8	MODE	
42	DE	9	DE	-
41	VSYNC	10	VSYNC	-
40	HSYNC	11	HSYNC	-
39	B7	12	B7	-
38	B6	13	B6	-
37	B5	14	B5	-
36	B4	15	B4	-
35	B3	16	B3	-
34	B2	17	B2	-
33	B1	18	B1	-
32	B0	19	B0	-
31	G7	20	G7	-
30	G6	21	G6	-
29	G5	22	G5	-
28	G4	23	G4	-
27	G3	24	G3	-
26	G2	25	G2	-
25	G1	26	G1	-
24	G0	27	G0	-
23	R7	28	R7	-
22	R6	29	R6	-
21	R5	30	R5	-
20	R4	31	R4	-
19	R3	32	R3	-
18	R2	33	R2	-
17	R1	34	R1	-
16	R0	35	R0	-
15	GND	36	GND	*
14	EXTCLK	37	DCLK	-
13	GND	38	GND	*
12	VCC33	39	L/R	TP8
11	GND	40	U/D	*
10	VGH	41	VGH	TP5
9	VGL	42	VGL	TP6
8	AVDD	43	AVDD	TP4
7	RESET_L	44	RESET	-

J2 Pin	Signal Description	LCD Panel Pin	LCD Signal Description	Test Point
6	NC	45	NC	-
5	VCOM	46	VCOM	TP7
4	GND	47	DITHB	*
3	GND	48	GND	*
2	NC	49	NC	-
1	NC	50	NC	-

***GND Test Points: TP9, TP10**

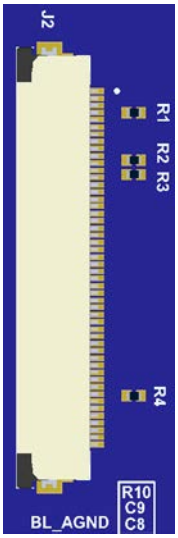

Figure 5. FPC Connector for LCD Data

4.3 FPC Connector for LCD Capacitive Touch (J3)

The TFT LCD capacitive touch panel connects to the Parallel Graphics Expansion Board 1 via the 10-pin FPC connector J3. The capacitive touch controller (FT5316) is controlled using I^2C. I^2C slave address: 0x38.

Table 3. FPC Connector for Capacitive Touch (J3)

J3 Pin	Signal Description	LCD Panel Description	Test Point
1	GND	GND	*
2	SDA	SDA	-
3	SCL	SCL	-
4	RESET_L	RESET	-
5	INT_L	INT	-
6	NC	NC	-
7	VCC33	VDD	TP8
8			
9	GND	GND	*
10			

***GND Test Points: TP9, TP10**

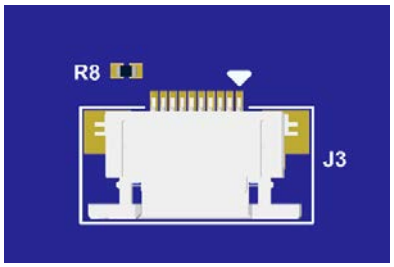

Figure 6. FPC Connector for LCD Capacitive Touch

4.4 LCD Backlight Controller (U1)

The display backlight is controlled by a Renesas ISL97682 backlight controller U1. This device implements compact 2 channel LED drivers each set to drive a constant current of 20mA. These are in parallel to provide a total of 40mA to the display backlight. The over voltage protection (OVP) pin is set to 10.2V max (9.6V nominal) to protect the LED backlight. Brightness can be controlled by applying a PWM signal to the backlight enable (BLEN) pin.

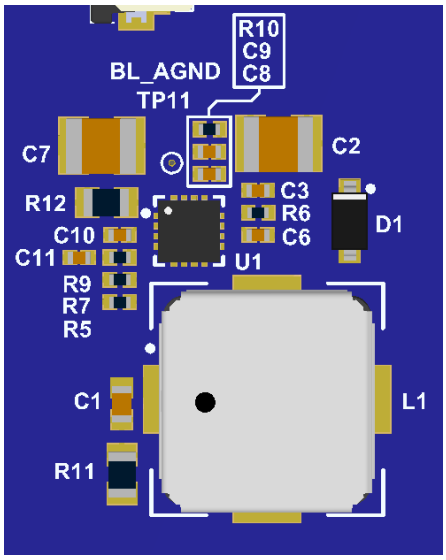

Figure 7. LCD Backlight Controller

4.5 Automotive Grade TFT-LCD Power Supply (U2)

The display backlight is controlled by a Renesas ISL78010 Automotive Grade TFT-LCD Power Supply U2. This device features a single boost converter with an integrated 2A FET for AVDD generation, two positive LDOs for VGH and VCOM generation, and a single negative LDO for VGL generation. The boost converter can be programmed to operate in either P-mode for optimal transient response or PI-mode for improved load regulation.

Note: The Schottky power rectifier D2 is rated for a maximum current of 1A, limiting the AVDD to a maximum current of 940mA.

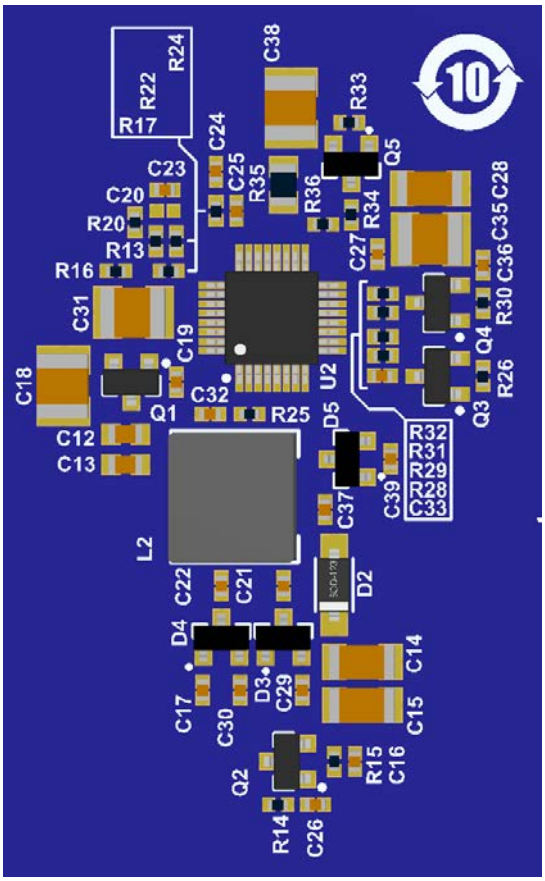

Figure 8. Automotive Grade TFT-LCD Power Supply

5. Certifications

The Parallel Graphics Expansion Board 1 v1 kit meets the following certifications/standards. See page 3 of this user's manual for the disclaimer and precautions.

5.1 EMC/EMI Standards

- FCC Notice (Class A)

  This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

  NOTE- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
  - Reorient or relocate the receiving antenna.
  - Increase the separation between the equipment and receiver.
  - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
  - Consult the dealer or an experienced radio/television technician for help.
- Innovation, Science and Economic Development Canada ICES-003 Compliance:

  CAN ICES-3 (A)/NMB-3(A)
- CE Class A (EMC)

  This product is herewith confirmed to comply with the requirements set out in the Council Directives on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility Directive 2014/30/EU.

  Warning – This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be requried to take adequate measures to correct this interference.
- UKCA Class A (EMC)

  This product is in conformity with the following relevant UK Statutory Instrument(s) (and its amendments): 2016 No. 1091 Electromagnetic Compatibility Regulations 2016.

  Warning – This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be requried to take adequate measures to correct this interference.
- Taiwan: Chinese National Standard 13438, C6357 compliance, Class A limits
- Australia/New Zealand AS/NZS CISPR 32:2015, Class A

5.2 Material Selection, Waste, Recycling and Disposal Standards

- EU RoHS
- WEEE Directive (2012/19/EU) & The Waste Electrical and Electronic Equipment Regulations 2013

  For customers in the UK & European Union the WEEE (Waste Electrical and Electronic Equipment) regulations put responsibilities on producers for the collection and recycling or disposal of electrical and electronic waste. Return of WEEE under these regulations is applicable in the UK and European Union.

  This equipment (including all accessories) is not intended for household use. After use the equipment cannot be disposed of as household waste, and the WEEE must be treated, recycled and disposed of in an environmentally sound manner.

  Renesas Electronics Europe GmbH can take back end of life equipment. Register for this service at; https://www.renesas.com/eu/en/support/regional-customer-support/weee
- China SJ/T 113642014, 10-year environmental protection use period.

5.3 Safety Standards

- UL 94V-0

6. Design and Manufacturing Information

The design and manufacturing information for the Parallel Graphics Expansion Board 1 v1 is available in the "APP_LCD-EK_PAR_1 v1 design package" available on renesas.com/app_lcd-ek_par_1.

- Design package file name: app_lcd-ek_par_1-v1-designpackage.zip

Table 4. Parallel Graphics Expansion Board 1 Design Package Contents

File Type	Content	File/Folder Name
File (PDF)	Schematics	app_lcd-ek_par_1-v1-schematics
File (PDF)	Mechanical Drawing	app_lcd-ek_par_1-v1-mechdwg
File (PDF)	3D Drawing	app_lcd-ek_par_1-v1-3d
File (PDF)	BOM	app_lcd-ek_par_1-v1-bom
Folder	Manufacturing Files	Manufacturing Files
Folder	Design Files	Design Files - Altium

7. Website and Support

Visit the following URLs to learn about the kit and the RA family of microcontrollers, download tools and documentation, and get support.

Parallel Graphics Expansion Board 1 Resources	renesas.com/app_lcd-ek_par_1
RA Kit Information	renesas.com/ra/kits
RA Product Information	renesas.com/ra
RA Product Support Forum	renesas.com/ra/forum
RA Videos	renesas.com/ra/videos
Renesas Support	renesas.com/support
RA Flexible Software Package (FSP)	renesas.com/fsp

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Jun.26.25	—	Initial Release
1.01	Aug.29.25	3, 10, 14	Updated Top Page, Figure 1, Section 1, 4.2 and 6

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