RT214C Integration Guide

RT214C

Contents

Introduction

The RT214C is an area image engine for barcode reading. It includes an illumination LED and an aiming LED.

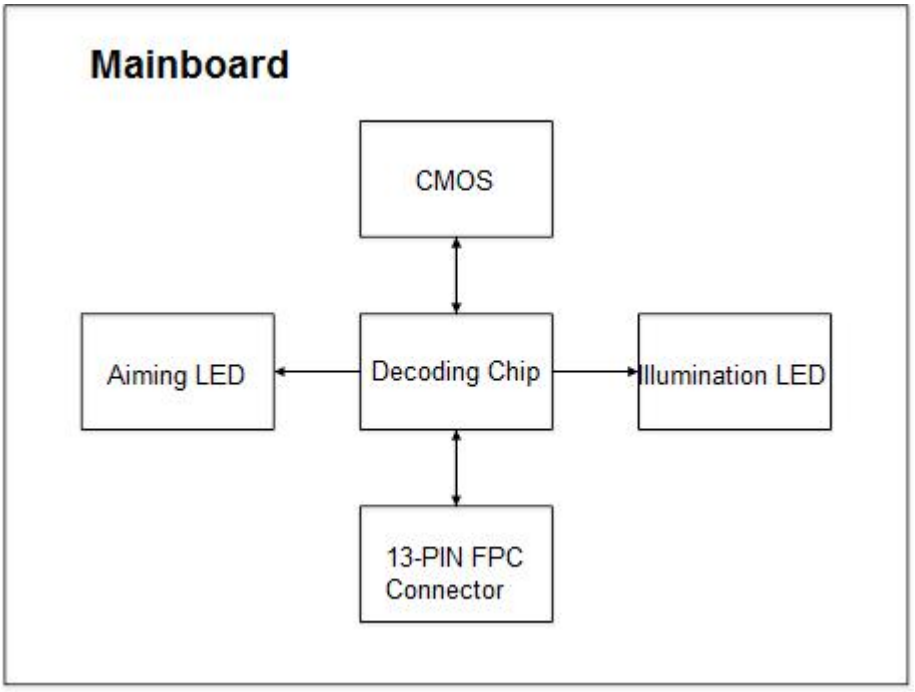
LED Compliance Statement

The RT214C complies with IEC 62471:2006 for LED safety.

The RT214C contains:

- a CMOS image sensor and its lens
- an LED based illumination system
- an LED aiming system

Figure 1-1 System Block Diagram



Illumination

The RT214C has a white LED for supplementary lighting, making it possible to scan barcodes even in complete darkness. The illumination can be programmed On or Off.

Aimer

The RT214C contains a red LED aimer to help the user to easily position the target barcode within the engine's field of view to increase scan efficiency. The aiming pattern can be turned On or Off. It is advisable to turn it on when scanning barcodes in regular circumstances. For applications in the background of different materials and colors or in the strong light or backlight environment, it is advised to turn off the aimer.

Introduction

This chapter explains how to install the RT214C, including general requirements, housing design, and physical and optical information.

△Caution: Do not touch the imaging lens when installing the engine. Be careful not to leave fingerprints on the lens.

△Caution: Do not touch the illumination LED during handling. Improper handling may damage the LED.

General Requirements

ESD

ESD protection has been taken into account when designing the RT214C. However, due to limited board space, additional ESD protection, such as TVS protection, is not provided on the engine's I/O interface. It is advised to take corresponding protection measures when integrating the engine.

The engine is shipped in ESD safe packaging. Always exercise care when handling the engine outside its package. Be sure grounding wrist straps and properly grounded work areas are used.

Dust and Dirt

The RT214C must be sufficiently enclosed to prevent dust particles from gathering on the lens and circuit board. Dust and other external contaminants will eventually degrade the engine's performance.

Ambient Environment

The following environmental requirements should be met to ensure good performance of the RT214C.

Table 2-1

Operating Temperature	-20°C to 55°C
Storage Temperature	-40°C to 70°C
Humidity	5% ~95% (non-condensing)

Thermal Considerations

Electronic components in the RT214C will generate heat during the course of their operation. Operating the RT214C in continuous mode for an extended period may cause temperatures to rise on CPU, CIS, LEDs, DC/DC, etc. Overheating can degrade image quality and affect scanning performance. Given that, the following precautions should be taken into consideration when integrating the RT214C.

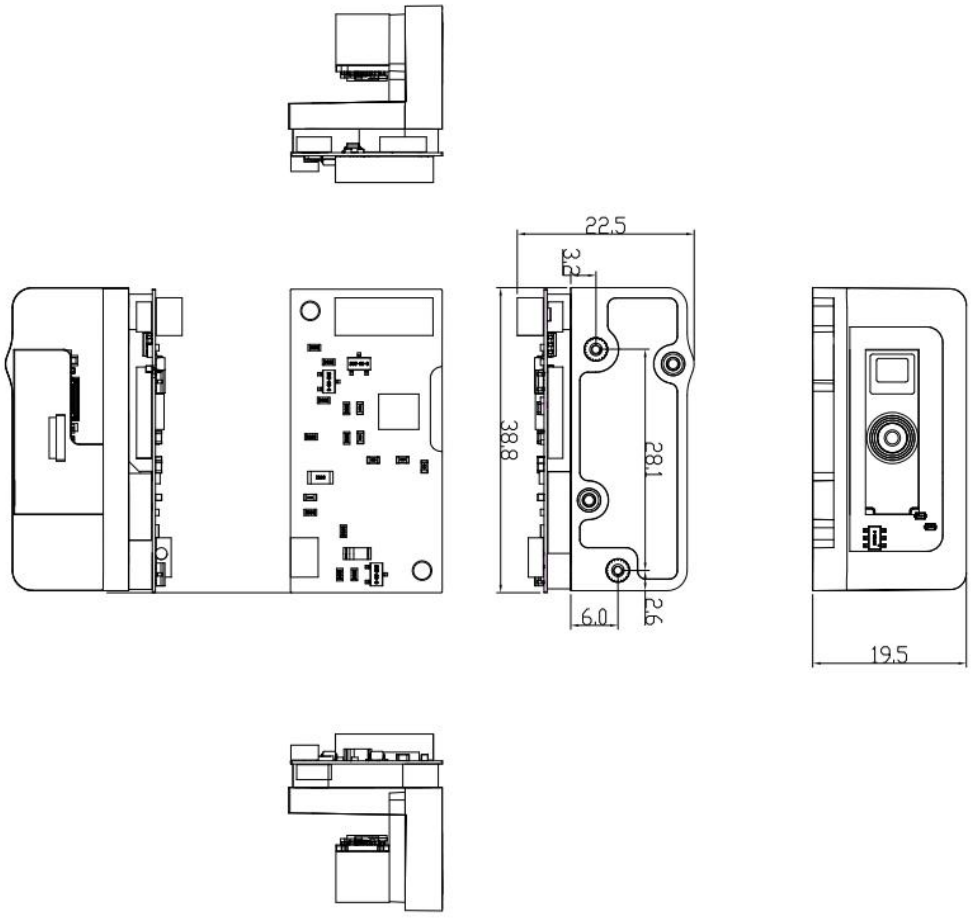
- ✧ Reserve sufficient space for good air circulation in the design.
- ✧ Avoid wrapping the RT214C with thermal insulation materials such as rubber.

External Optical Elements

Do not subject external optical components on the engine to any external force. Do not hold the engine by an external optical component, which may cause the mechanical joints that secure the components to crack or break due to excessive stress.

Mounting

The illustrations below show the mechanical mounting dimensions (unit: mm) for the **RT214CC**.



Note: Tolerance of dimension is ±0.15mm.

Housing Design

※ Note: Conduct an optical analysis for the housing design to ensure optimal scanning and imaging performance.

Housing design should make sure that internal reflections from the aiming and illumination system are not directed back to the engine. The reflections from the housing or window can cause problems. Avoid any highly reflective objects around the engine that can cause bright spots to appear in the captured image. It is recommended to use baffles or matte-finished dark internal housing colors.

Optics

The RT214C uses a sophisticated optical system. An improperly designed internal housing or improper selection of window material can degrade the engine's performance.

Window Placement

The window should be positioned properly to let the illumination and aiming beams pass through as much as possible and no reflections back into the engine (reflections can degrade the reading performance of the engine).

There are two window placement options.

• **Parallel window** – Primary option for imager engines. The following window distance requirements should be satisfied: The maximum distance is measured from the front of the engine housing to the furthest surface of the window. In order to reach better reading performance, the distance from the front of the engine housing to the nearest surface of the window should not exceed **a** (a=0.1mm) and the distance from the front of the engine housing to the furthest surface of the window should not exceed **a+d** (a=0.1mm, d=2mm), as shown in **Figure 2-2**.

• **Tilted window** - This option is for laser/imager engines. For the tilted window distance requirements, please see **Table 2-2**.

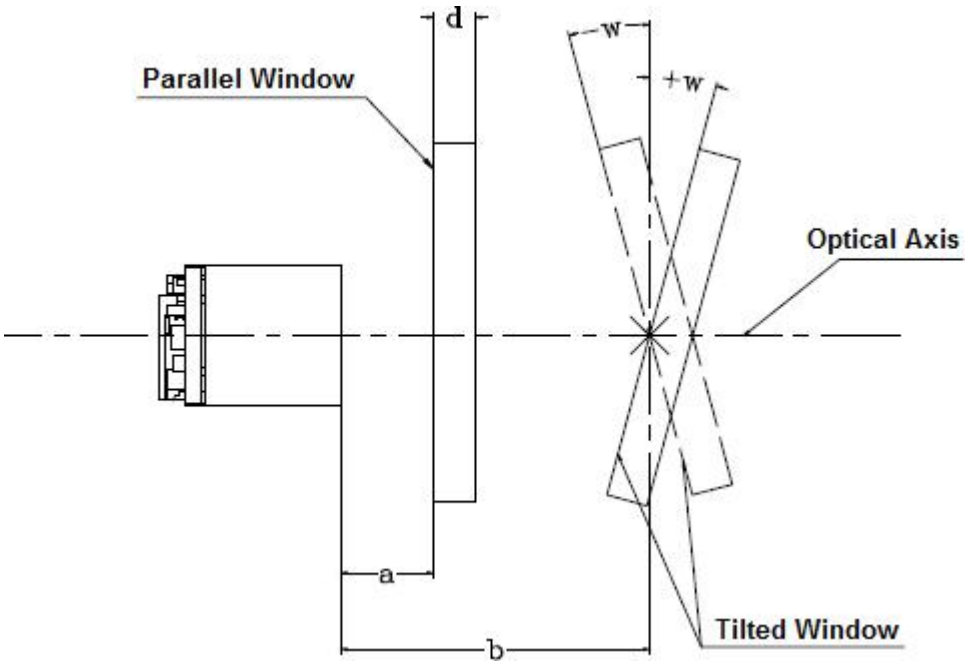


Figure 2-2

Table 2-2

Minimum Angle (Tilted Window)	Distance from the front of the engine housing (b)		
	10mm	15mm	20mm
Uncoated, minimum window positive tilt (+w)	35°	30°	28°
Uncoated, minimum window negative tilt (-w)			

Window Material and Color

Window material must be clear. Use only cell-cast plastics or optical glass. PMMA and chemically tempered glass are recommended. Window material selected for the engine should meet or exceed the specifications specified in **Table 2-3**. When using a clear plastic window, it is recommended to apply anti-reflection (AR) coating on it.

- **PMMA (Cell-cast acrylic):** When fabricated by cell-casting, has very good optical quality and low initial cost, but surface must be protected from the environment due to its susceptibility to attack by chemcials, mechanical stresses, and UV light. Reasonably good impact resistance.
- **Chemically tempered glass:** Glass is a hard material which provides excellent scratch and abrasion resistance. But unannealed glass is brittle. Increased flexibility strength with minimal optical distortion requires chemical tempering. Glass is hard to be cut into odd shapes and cannot be ultrasonically welded.

Table 2-3

Specification	Description
Spectral Transmittance	≥90% (PMMA) ≥91% (Chemically tempered glass)
Thickness	0.5-2.0mm
Light Wavelength	400-780nm
Clear Aperture	1.0mm to edges
Surface Quality	60-20 scratch/dig

Pay extra attention to the light wavelength when using plastic materials. Colored windows are not recommended if the engine is used to scan barcodes on moving objects.

Coatings and Scratch Resistance

Scratch on the window can greatly reduce the performance of the RT214C. It is suggested to use abrasion resistant window material or coating.

The following introduces two commonly-used types of coatings:

- **Anti-reflection coatings:** Anti-reflection (AR) coatings can be applied to window surfaces to reduce reflected light from the window back into the engine. Multi-layer AR coatings on windows help to achieve less than 0.5% reflectance and covered wavelength is 400-780nm.

- **Scratch resistance coatings:** Scratch resistance coatings require a degree of greater than 5H in its hardness. Coatings can be applied to plastic surfaces to increase the surfaces' abrasion and scratch resistance.

Both tempered glass and plastic windows can be AR coated. However, it is easier and more cost-effective to put an AR coating on the glass than on the plastic.

The AR coating specifications below should be met when using an AR coated window.
Single side AR coating: 93% minimum transmittance within spectrum range from 400 nm to 780 nm.
Double side AR coating: 97% minimum transmittance within spectrum range from 400 nm to 780 nm.

Window Size

The window must not block the field of view and should be sized to accommodate the aiming and illumination envelopes shown below.

Horizontal:

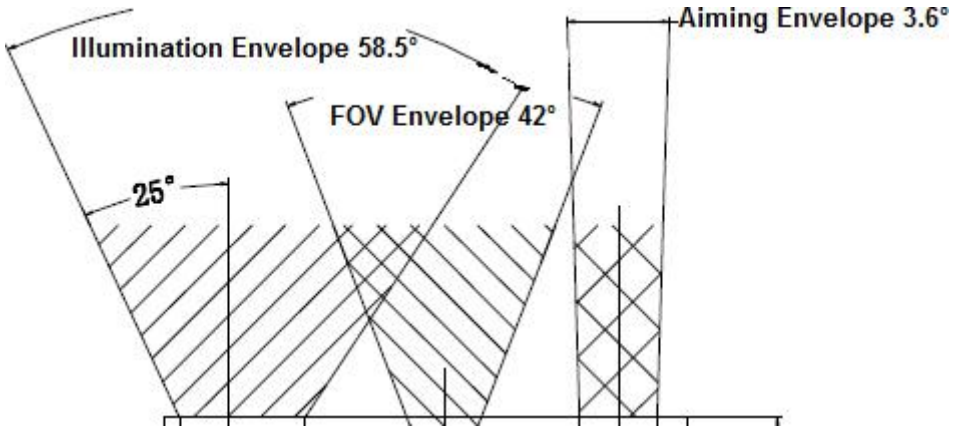


Figure 2-3

Vertical:

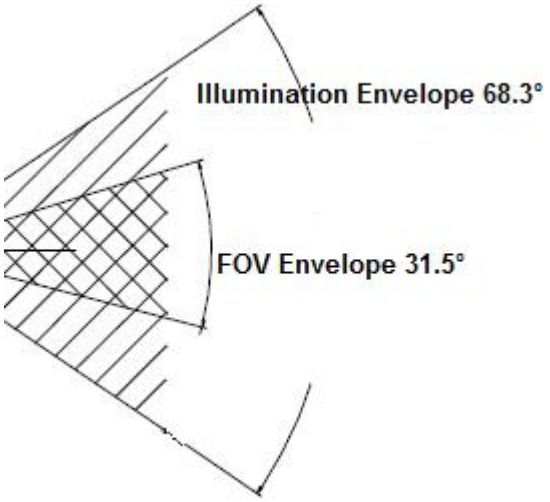


Figure 2-4

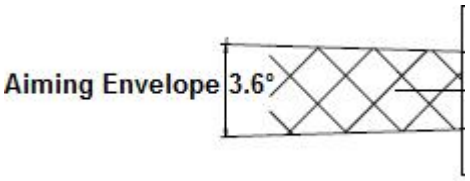


Figure 2-5

Roll, Skew and Pitch

Three different reading angles, roll, skew and pitch are illustrated in **Figure 2-6**. Roll refers to rotation around the Z axis, skew to rotation around the X axis and pitch to rotation around the Y axis. For the engine's technical specifications, please visit the RTscan website or contact your dealer.

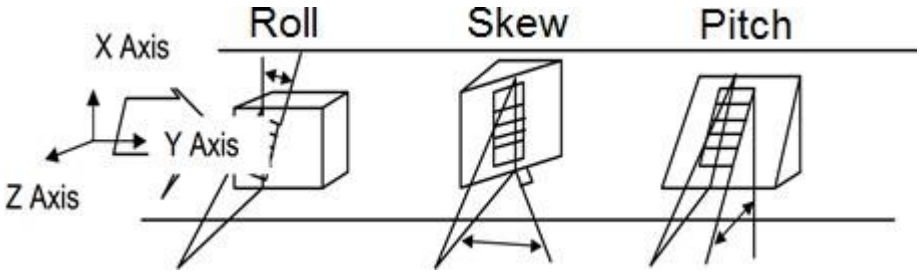


Figure 2-6

Ambient Light

The RT214C shows better performance with ambient light. However, high-frequency pulsed light can result in performance degradation.

Eye Safety

The RT214C has no lasers. It uses LEDs to produce illumination beam. The LEDs are bright, but testing has been done to demonstrate that the engine is safe for its intended application under normal usage conditions. However, the user should avoid looking into the beam.

Power Supply

Do not power up the RT214C until it is properly connected. Be sure the power is cut off before connecting a cable to or disconnecting a cable from the host interface connector. Hot-plugging could damage the engine.

Unstable power supply or sharp voltage drops or unreasonably short interval between power-ons may lead to unstable performance of the engine. Do not resupply the power immediately after cutting it off.

※ When designing, the user should ensure that the input power of RT214C is fully decoupled. It is recommended to place a 22uF and a 100nF X5R or X7R ceramic capacitor beside the power input pin on the connector which is soldered on the board. The capacitor mounted on the external input power supply is recommended to be controlled within 50uF.

※ Ensure that the input power drops below 0.5V before powering the RT214C on again, otherwise it will lead to abnormal function.

Ripple Noise

To ensure the image quality, a power supply with low ripple noise is needed. Acceptable ripple range (peak-to-peak) :≤100mV

Interface:

The physical interface of the RT214C can be two options:

Option 1: USB or 6PIN Dupont Cable

PIN#	Signal	I/O	Function
1	GND	Power	0V
2	RXD_232	I/O	TTL232/RS232 receive, TTL232 default, **RS232 need to be customized**
3	TXD_232	I/O	TTL232/RS232 send, TTL232 default, **RS232 need to be customized**
4	D+	I/O	USB D+
5	D-	I/O	USB D-
6	VCC	Power	Power 5V

The PCB board consist beeper and even a button, we can use it with USB output directly, or connect via 6 pin Dupont cable (with TTL232 signal) to your terminal.

Option 2: 12pins TTL-232 flat cable

Take off the PCB, output via 12pin flat cable directly as below picture.

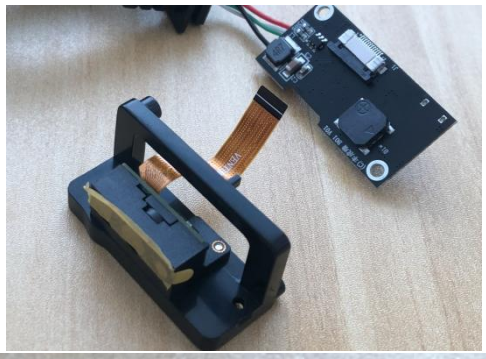


Table 4-2

12-pin connector (Pin definition of pinout of RT214C)

PIN#	Signal Name	I/O	State	Function
1	NC	-	-	-
2	VDD	-	-	3.3V power input
3	GND	-	-	Power-supply ground
4	RXD	I	-	TTL level 232 receive data

5	TXD	O	-	TTL level 232 transmit data
6	USB_D-	-	-	USB_D- signal
7	USB_D+	-	-	USB_D+ signal
8	NC	-	-	-
9	BUZ	O	-	Beeper output
10	LED	O	-	Good Read LED output
11	nRST	I	-	Reset signal input
12	nTRIG	I	-	Trigger signal input

Note: please remember your device's TXD should be connected to RXD of RT214C, and RXD to TXD.

The 12-PIN connector is shown as below.

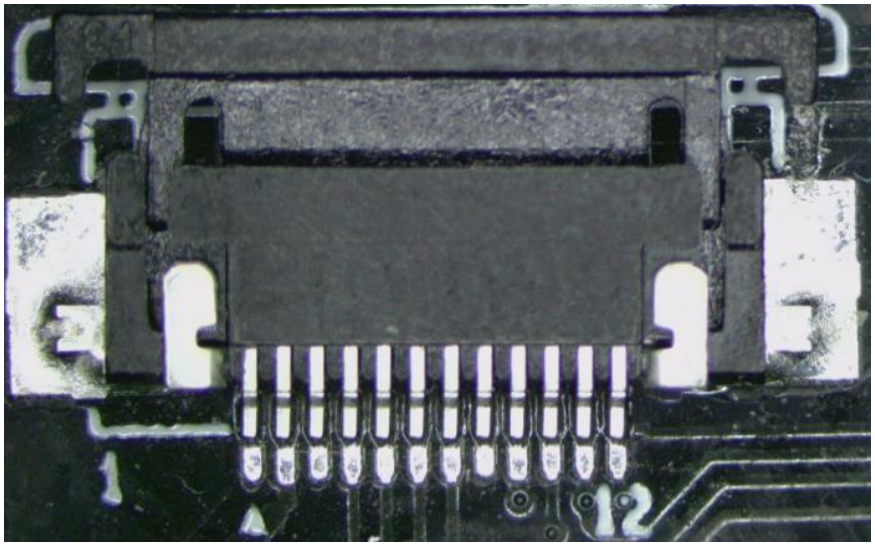


Figure 4-2

Connector Specifications

The RT214C is equipped with a 13-pin FPC connector. The connector is supplied by Hirose Corporation, Model No.: FH35C-13S-0.3SHW(50). For more information about the connector, please visit https://www.hirose.com/.

Note:

1. In order to improve the connecting stability,using the downward connection priority.
2. Do not close the connector before inserting the FPC cable.
3. Please avoid operating the connector more times.

External Circuit Design

Beeper Circuit

The circuit below is used to drive an external beeper. The nBEEPER signal is from PIN 5 of the 13-pin FPC connector.

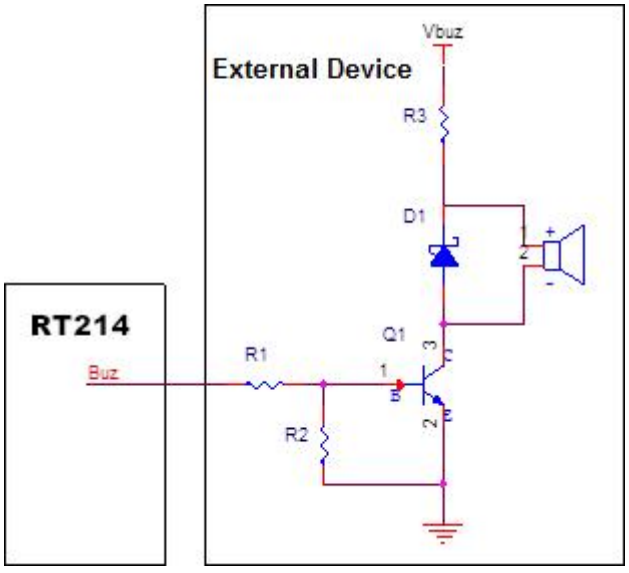


Figure 5-2

External Illumination Control Circuit

Pin 6 (Ext.LED.Crtl) on the13-pin FPC connector is the external illumination control signal. I/O is in the Floating state before initialization. When the external illumination is not enabled, I/O is configured as the input pin. When enabled, I/O is the output pin in working mode and input pin in the sleep mode. For external illumination, please refer to the user guide for software

configuration. The duration from the Ext LED Crtl signal output to the external illumination should not exceed 100us.

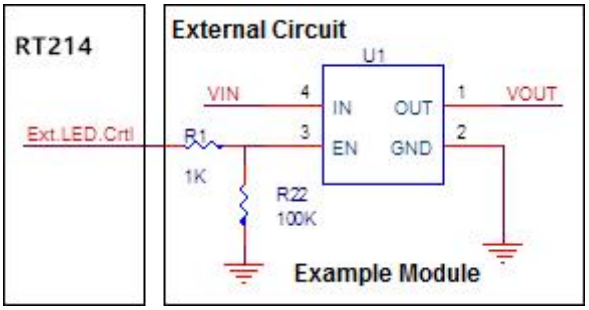


Figure 5-4

For Any Technical Support, please contact us at:
support@rtscan.net