RT209
OEM Scan Engine

Integration Guide

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Chapter 1 Introduction

Overview

The RT209 supports all mainstream 1D as well as PDF417, QR Code (QR1, QR2, Micro QR), Chinese Sensible Code, Data Matrix and GS1-DataBar^{TM}(RSS) (Limited/ Stacked/ Expanded versions).

Aimer

The RT209 has a view finder that produces a bar-shaped aiming pattern 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.

Illumination

The RT209 has several red LEDs (wavelength: 625±10nm) for supplementary lighting, making it possible to scan barcodes even in complete darkness. The illumination can be programmed On or Off.

The RT209 uses red LEDs for illumination, so the engine shows better reading performance on barcodes printed in non-red colors. For applications involving red barcodes, it is advised to turn off the engine's illumination and use non-red supplementary lighting (such as green) instead. The user can conduct some tests to determine the proper wavelengths to be used.

Chapter 2 Installation

General Requirements

ESD

ESD protection has been taken into account when designing the RT209 and 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 RT209 must be sufficiently enclosed to prevent dust particles from gathering on the lens, circuit boards and LEDs. Dust and other contaminants will eventually degrade the engine's performance.

Ambient Environment

The following environmental requirements should be met to ensure good performance of the RT209:

|	
Operating Temperature	-20℃ to 55℃
Storage Temperature	-40℃ to 80℃
Humidity	5% ~ 95% (non-condensing)

Thermal Considerations

Electronic components in the RT209 will generate heat during the course of their operation. Operating the RT209 continuously for an extended period may cause temperatures to rise on CIS and decoder chip. Overheating can degrade image quality and affect scanning performance. Given that, the following precautions should be taken into consideration when integrating the RT209.

✧ Reserve sufficient space for good air circulation during design.

✧ Avoid wrapping the RT209 with thermal insulation materials such as rubber.

Installation Orientation

The following figure illustrates a front view of the RT209 after installation.
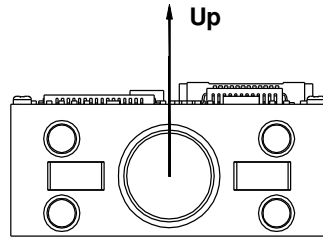
Optics

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).

The window should be mounted close to the front of the engine (parallel). The maximum distance is measured from the front of the engine housing to the furthest surface of the window. Avoid unwanted reflections and use thin material for window so as to reach better reading performance. As shown in the figure below, the distance from the front of the engine housing to the furthest surface of the window should not exceed 3mm and the distance from the front of the engine housing to the nearest surface of the window should not exceed 2mm.
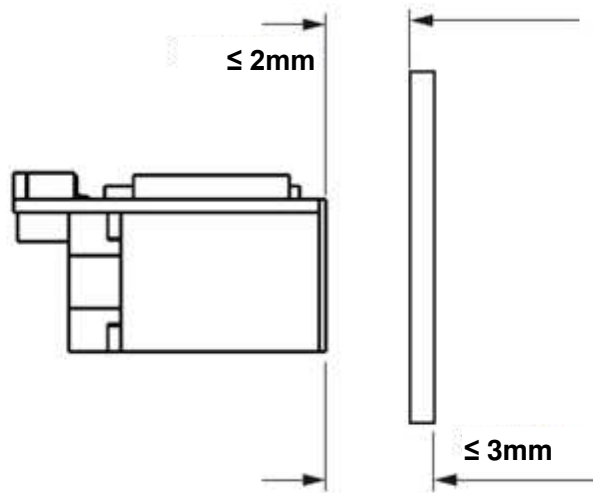
If the window is required to be in a tilted position, the above distance requirements should be met and tilt angle should ensure no reflections back into the lens.

Window Material and Color

Wavelengths of illumination and aiming beams should be taken into consideration when choosing window material and color, to achieve the possible highest spectral transmission, lowest haze level and homogeneous refractive index. It is suggested to use PMMA or optical glass with spectral transmittance of illumination and aiming beams over 90% and haze less than 1%. Whether to use an anti-reflection coating or not depends on the material and application needs.
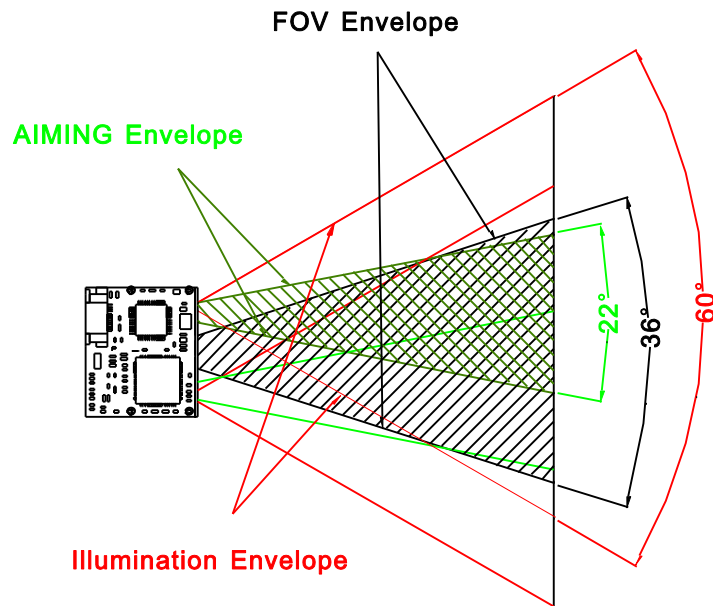
Scratch Resistance and Coating

Scratch on the window can greatly reduce the performance of the RT209. It is suggested to use abrasion resistant window material or coating.

Window Size

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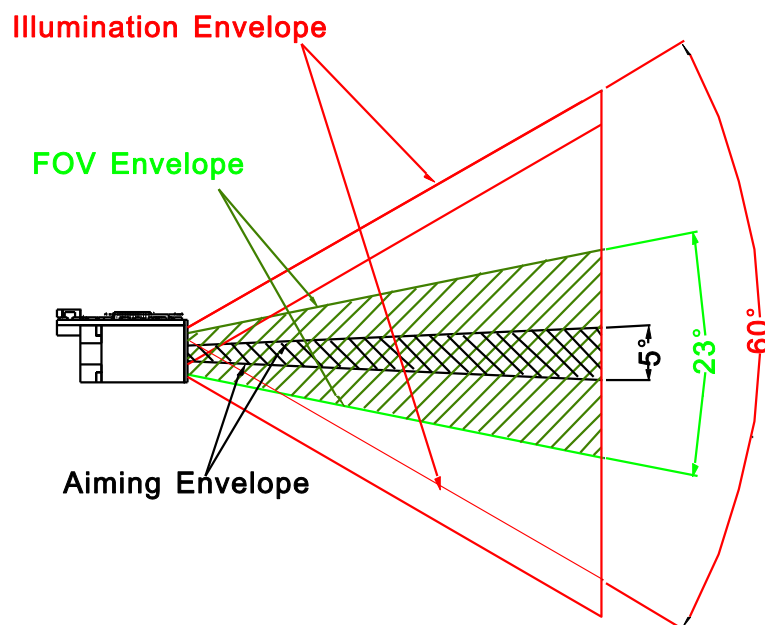
Ambient Light

The RT209 shows better performance with ambient light. However, high-frequency pulsed light can result in performance degradation.

Eye Safety

The RT209 has no lasers. It uses LEDs that create the aiming and illumination beams. These 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.

Mounting

The illustrations below show the mechanical mounting dimensions for the RT209. The structural design should leave some space between components and provide sufficient space for FFC cable.

Elements listed in previous sections should also be taken into consideration when integrating the RT209.

Front View (unit: mm)

28.0±0.1

Left View (unit: mm)

13.8±0.3

8.3±0.1

19.77±0.1

24.0±0.1
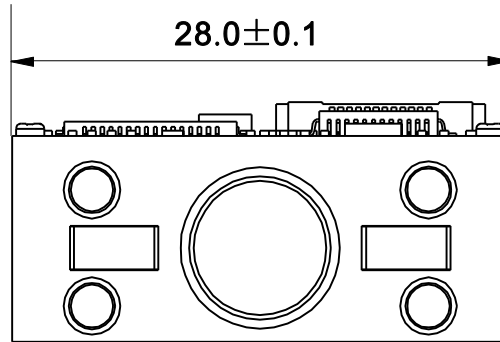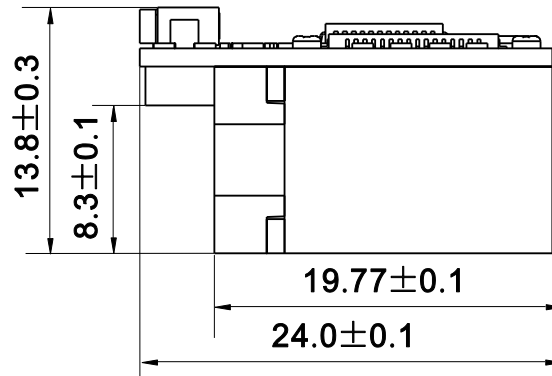
Bottom View (unit: mm)

The bottom view shows the mounting screw specification (M2, machine screw with an internal diameter of 2mm). Note that the part of mounting screws into the engine cannot exceed 3mm.

24.0±0.05

11.0±0.1

M2×3
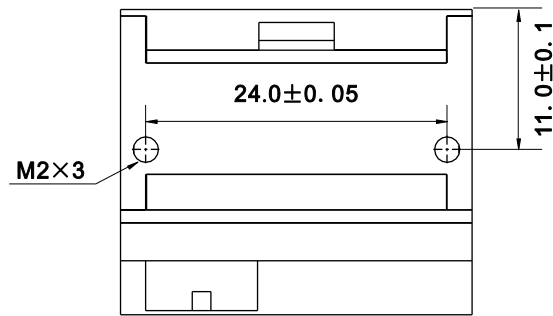
Chapter 3 Electrical Specifications

Power Supply

Do not power up the RT209 until it is properly connected. Be sure the power is cut off before connecting a flexible cable to or disconnecting a flexible 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. The minimum interval must exceed 2 seconds.

Ripple Noise

The image sensor is directly fed by the input power of RT209. To ensure the image quality, a power supply with low ripple noise is needed.

Acceptable ripple range (peak-to-peak) : ≤50mV (≤30mV recommended).

DC Characteristics

Operating Voltage

Ta=25℃

Parameter	Minimum	Typical	Maximum	Unit
V_{CC}	3.1	3.3	3.6	V
V_{IH}	V_{CC}-0.5	-	-	V
V_{IL}	-	-	0.5	V
V_{OH}	V_{CC}-0.3	-	-	V
V_{OL}	-	-	0.3	V

Current

Ta=25℃，V_{CC}=3.3V

| Parameter	Average	Maximum	Unit
I_{OP}	190	-	mA
$I_{Standby}$	7	-	mA
$I_{Low\ power}$	5	-	uA

Chapter 4 Interfaces

The following table lists the pin functions of the 12-pin host interface connector on the RT209. Refer to the **"Cable Connection"** section in this chapter for the location of Pin 1.

| PIN#	Signal Name	I/O	Function
1	VCC	-	Power supply.
2	VCC	-	Power supply.
3	GND	-	Power-supply ground.
4	RX	Input	TTL level 232 receive data.
5	TX	Output	TTL level 232 transmit data.
6	D-	Input/Output	USB D- differential data signal
7	D+	Input/Output	USB D+ differential data signal
8	GND	-	Power-supply ground.
9	BUZ	Output	Beeper output. For the information of external beeper driver circuit, see the **Control Interfaces** section.
10	LED	Output	Good Read LED output. For the information of external LED driver circuit, see the **Control Interfaces** section.
11	RESET	Input	Reset signal input: Driving this pin low for at least 100µs-500µs resets the RT209.
12	TRIG	Input	Trigger signal input: Driving this pin low for at least 10ms causes the RT209 to start a scan and decode session.

Host Interface Connector

The RT209's host interface connector is a 12-pin ZIF socket (bottom contact) which can be used to connect a host device (e.g., software development board EVK) with an FFC cable. The following figures show the location and dimensions of the socket. (unit: mm)
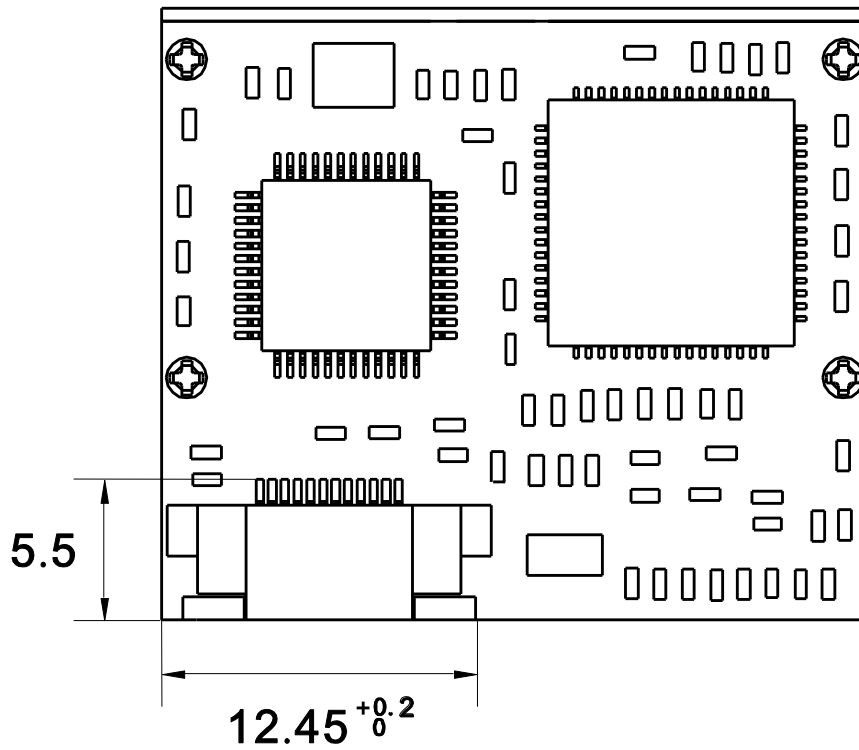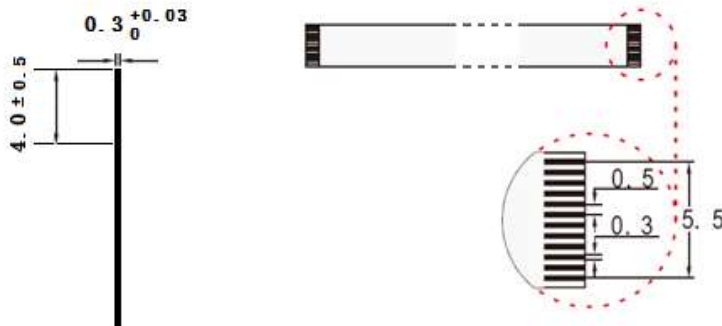
Dimensions of the Host Interface Connector

unit: mm
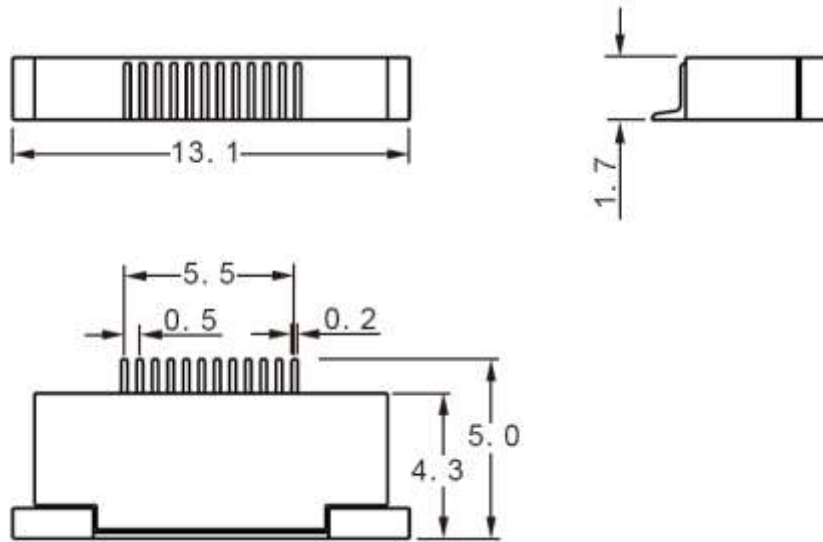
FFC Cable

A 12-pin FFC cable can be used to connect the RT209 to a host device. The cable design must be consistent with the following specifications shown below. Use reinforcement material for the connectors on the cable and reduce cable impedance for reliable connection and stable performance.
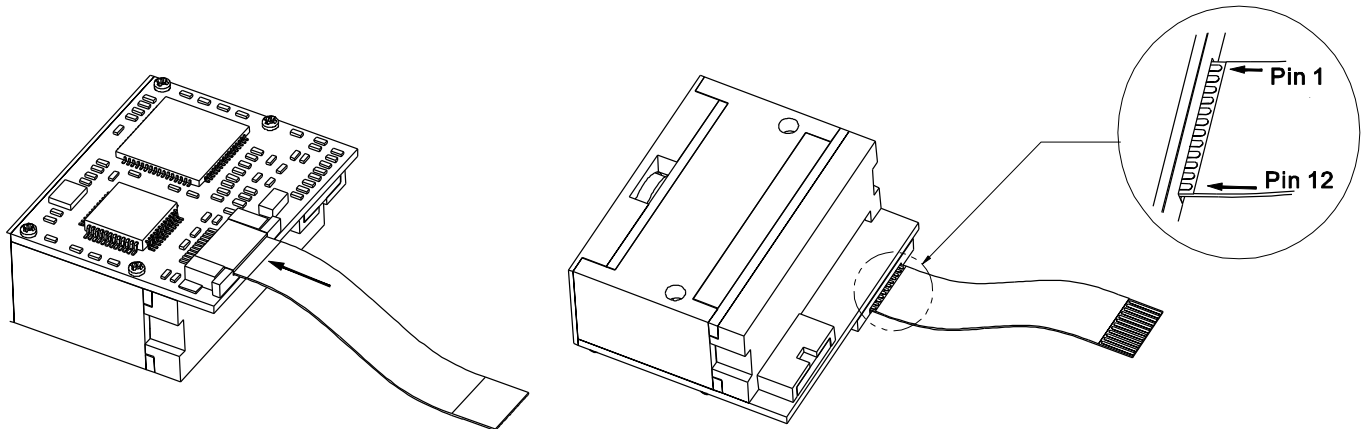
unit: mm

Cable Connection

Be sure the power is cut off before connecting a flexible cable to the host interface connector on the RT209. Hot plugging could damage the engine or the host device.

Connect the RT209 to a host device with a 12-pin flexible cable as shown in the following figure.

Communication Interfaces

The RT209 can communicate with the host device through either TTL-232 serial port or USB port using one of the following communication modes.

✧ TTL-232: This interface is applicable to most system architectures. For those requiring RS-232, a TTL-232 to RS-232 conversion circuit is needed.

✧ USB HID-KBW: Based on USB connection, the engine's transmission is simulated as USB keyboard input. It works on a Plug and Play basis and no driver is required.

✧ USB COM Port Emulation: The USB port on the host device is emulated as a serial port with the same data transmission and configuration as a real serial port. A driver is required.

✧ USB HID-POS: It is based on HID with no need for custom driver and is way more efficient in communication than keyboard emulation and traditional RS-232 interface.

The RT209's serial port supports baud rates from 1200bps to 115200bps; it does not support hardware flow control.

Control Interfaces

Reset

Driving the RESET pin (PIN 11) on the host interface connector low for 100µs-500µs and then having the signal back to high or idle high level resets the RT209.

The minimum interval between reset operations must exceed 2 seconds.

Trigger

Driving the TRIG pin (PIN 12) on the host interface connector low for a specified time period causes the RT209 to start a scan and decode session. The time period varies from one scan mode to another. Anti-shake mechanism is used in level trigger mode. For this mode, a trigger begins when the signal from the TRIG pin remains low for at least 10ms.

For those scan modes with a timeout mechanism, the trigger automatically deactivates when the timeout expires. After a trigger ends, the engine gets ready for next trigger only if the signal from the TRIG pin stays high for at least 10ms.

Beeper

The RT209 provides a pin (BUZ, PIN 9) on the host interface connector that provides a PWM output to an external driver circuit for generating audible feedback to the user to indicate statuses like power up, good read or operation error. The PWM output is not strong enough to drive a beeper, so a beeper driver circuit is needed.

The following beeper driver circuit is provided for reference.
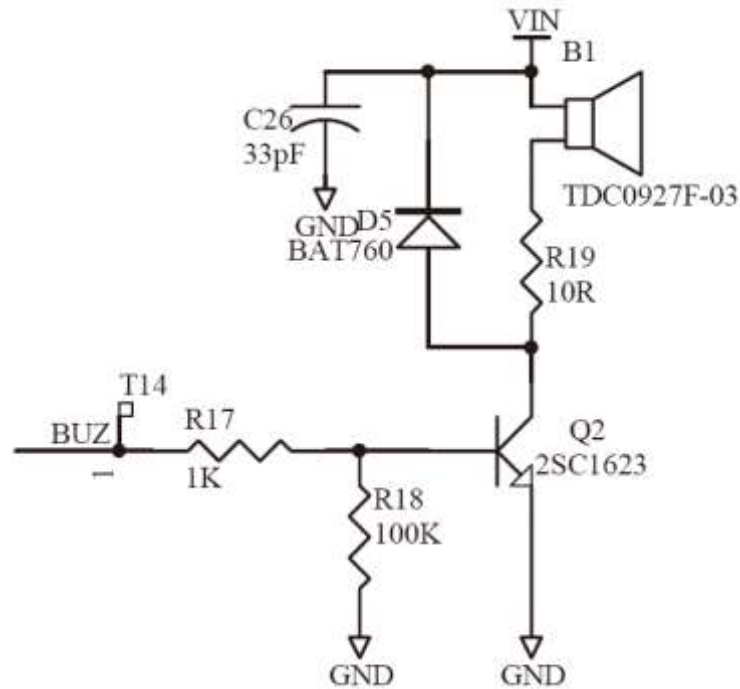
Good Read LED

The RT209 provides a pin (LED, PIN 10) on the host interface connector that can be used by an external driver circuit to drive an LED to indicate a good read status. When a good read occurs, the signal from the LED pin turns from a low level into alternation of high and low levels and a while later back to a low level. This Good Read LED output is not strong enough to drive an LED, so an LED driver circuit is needed.

The following LED driver circuit is provided for reference.
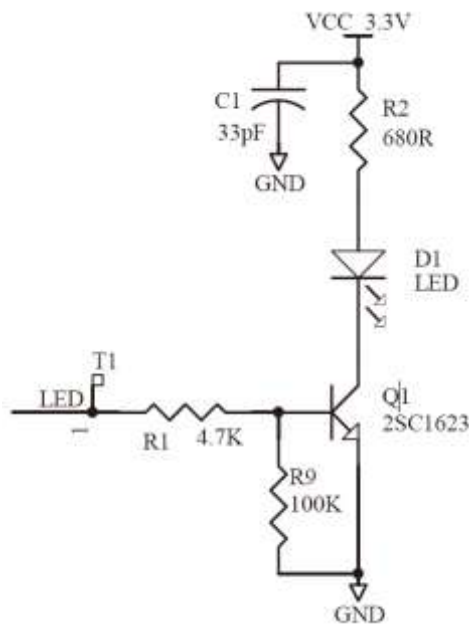
Chapter 5 Development Tools

The RT209's development tools can be utilized for engine performance evaluation, application development and engine configuration.

EVK

The EVK is provided to help users to test and evaluate the RT209, which contains beeper & beeper driver circuit, LED & LED driver circuit, trigger & reset buttons, TTL-232 to RS-232 converter & TTL-232 to USB converter, RS-232 & USB interfaces, etc. The RT209 can be connected to the EVK via a 12-pin FFC cable type 1 (contacts on the same side). Either USB connection or RS-232 connection can be used when connecting the EVK to a host device.

QuickSet/uExpress

A bunch of software such as QuickSet and uExpress is provided to assist users in function settings for the RT209 under Windows.