iN1 DPM Scanner Integration Guide

Contents

Introduction

The iN1 is an area image engine for barcode reading. It includes two illumination LED lights--one red and one white, and one laser aiming.

LED Compliance Statement

The iN1 complies with IEC 60825-1:2014 for laser safety.

The iN1 contains:

- a CMOS image sensor and its lens
- two LED lights based illumination system, one red and one white
- a laser aiming system

System Block Diagram

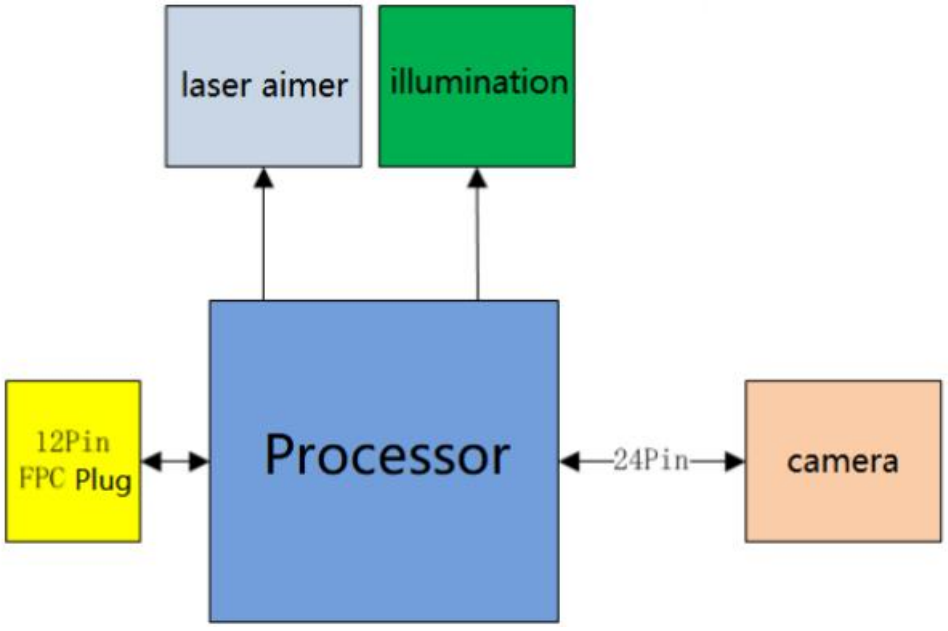


Figure 1-1

Illumination

The iN1 has two LED lights(one white LED and one red LED) for supplementary lighting, making it possible to scan barcodes even in complete darkness. The illumination lights can be programmed On or Off.

Aimer

The iN1 contains a red cross laser 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 iN1, 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 iN1. 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 iN1 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 iN1.

Table 2-1

Operating Temperature	-20°C to 50°C
Storage Temperature	-40°C to 70°C
Humidity	5% ~95% (non-condensing)

Thermal Considerations

Electronic components in the iN1 will generate heat during the course of their operation. Operating the iN1 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 iN1.

- ✧ Reserve sufficient space for good air circulation in the design.
- ✧ Avoid wrapping the iN1 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 iN1.

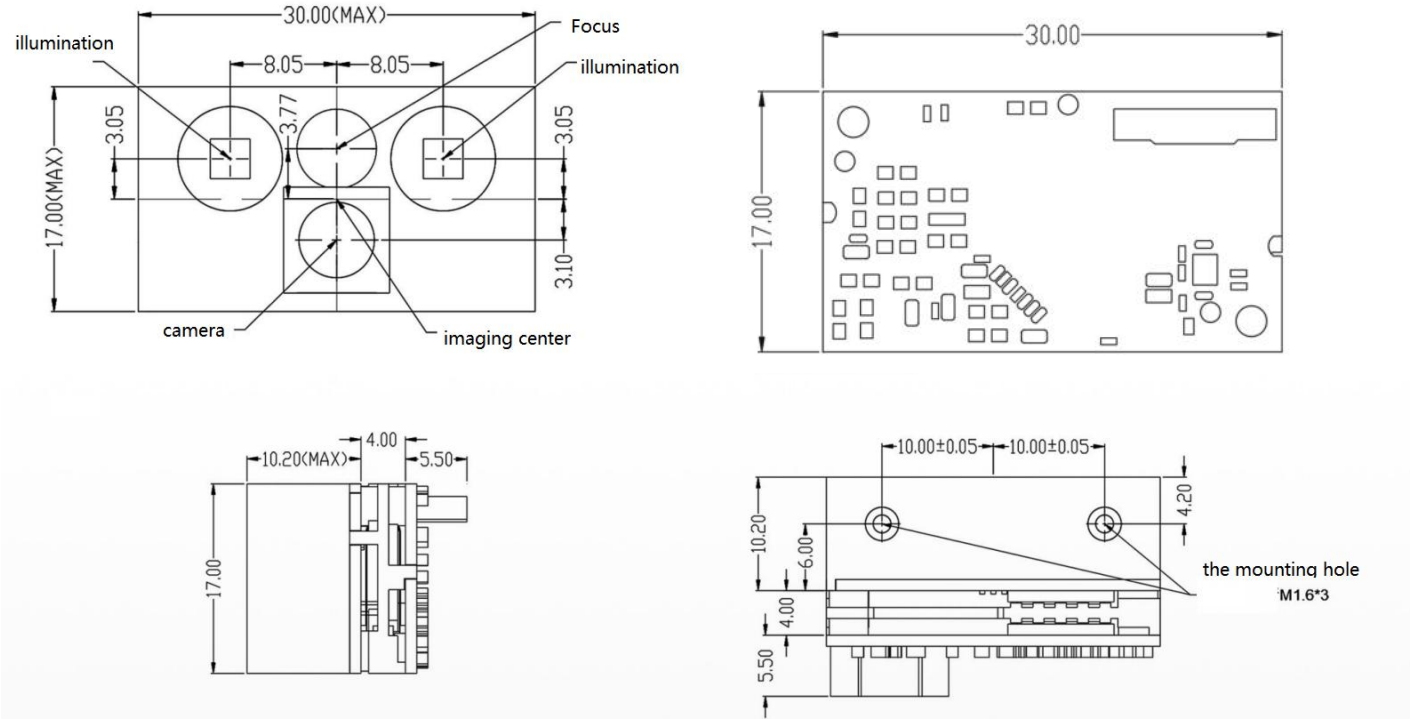


Figure 2-1

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 iN1 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**.

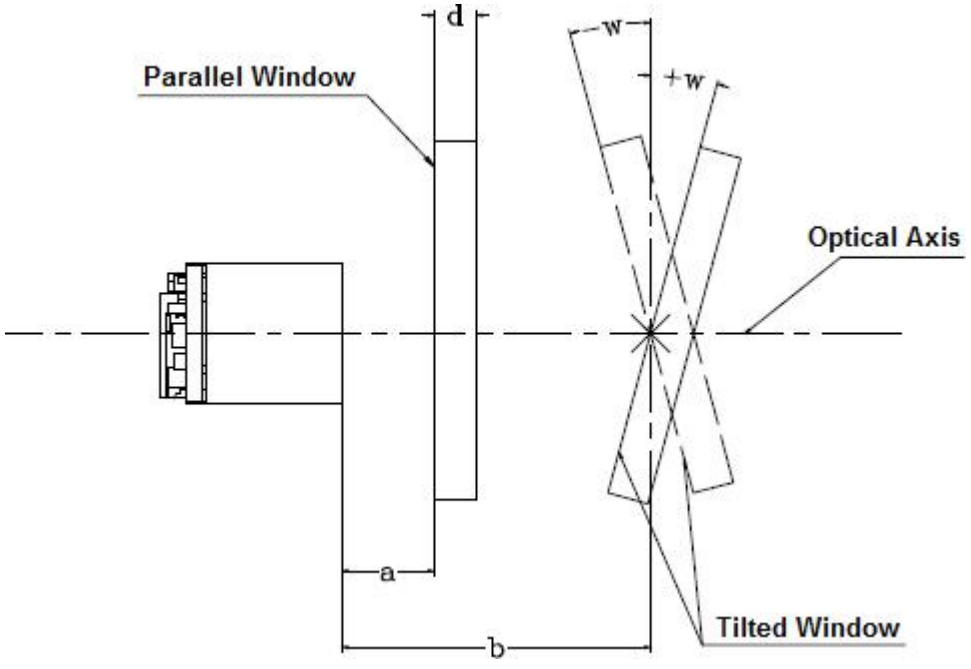


Figure 2-2

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 iN1. 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

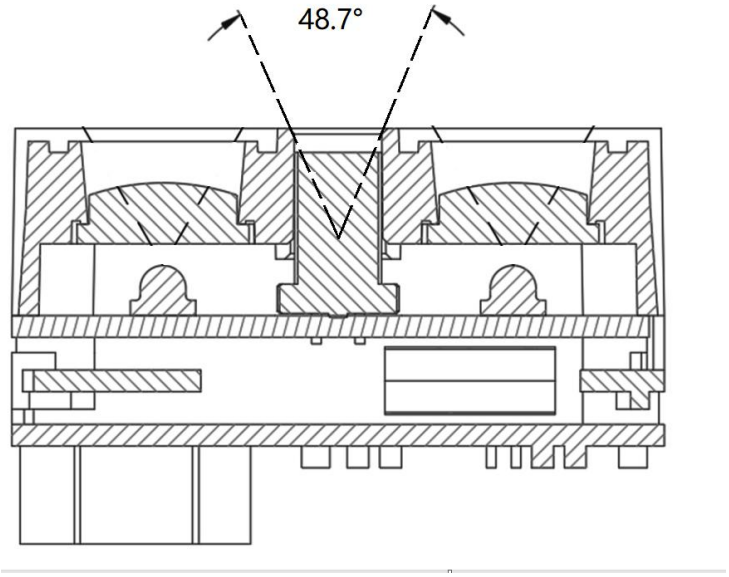


Figure 2-3

Vertical

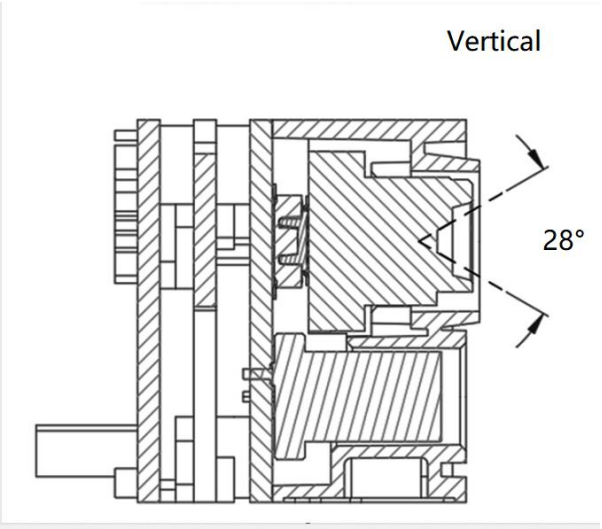


Figure 2-4

Roll, Skew and Pitch

Three different reading angles, roll, skew and pitch are illustrated in **Figure 2-5**. 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.

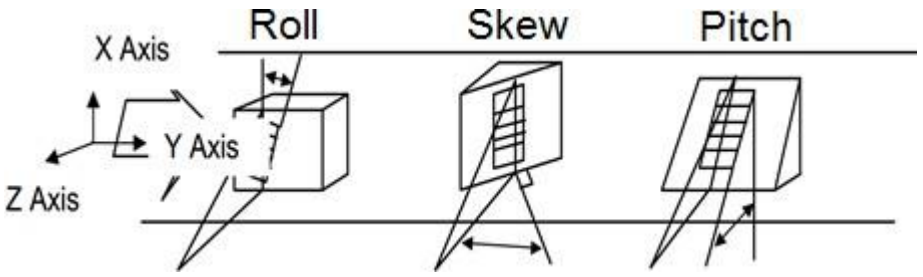


Figure 2-5

Ambient Light

The iN1 shows better performance with ambient light. However, high-frequency pulsed light can result in performance degradation.

Eye Safety

The iN1 has a laser cross aimer which has passed the IEC60825-1:2014.
The tests 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 as much as possible.

Power Supply

Do not power up the iN1 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-on may lead to unstable performance of the engine. Do not resupply the power immediately after cutting it off.

The power supply voltage is 3.3V ± 5 %. If too high, it will cause the main control to burn out;

Please ensure that the Rdc (DC resistance) of the connecting wire is controlled within 0.35 ohms;

Do not connect the scanner with the FPC cable when the power is on.

Ripple Noise

To ensure the image quality, a low noise power supply is required.

Acceptable ripple range (peak-to-peak) :≤100mV

You may pay due attention to the power quality and test to ensure the best performance from the scanner.

DC Characteristics

Operating Voltage

Table 3-1

T=25°C

Parameter	Description	Minimum	Typical	Maximum	Unit
VDD	Input Voltage	3.14	3.3	3.47	V

Operating Current

Table 3-2

T=25°C

Description	State	PEAK	RMS	Unit
Working Current	VDD=3.3V±5%	600	140	mA
Standby Current		58	58	mA

Note:

1. The maximum input current overshoot when the module is powered on is 600 mA;
2. In order to ensure the reliability of the scanner, we recommend that the external VDD terminal can provide at least 600mA current;
3. Thus, when you design the connecting wire, it should be ensured that the Rdc (DC resistance) of the connecting wire is controlled within 0.35 ohms, which can be achieved by increasing the trace width of the power line, increasing the trace width of the ground wire, reducing the length of the FPC line, or increasing the line Copper thickness, etc.
4. Please notice that the copper thickness would lead to a poor bending performance of the cable, please evaluate the feasibility according to the actual application;
5. As the excessive cable loss will cause the modules to work abnormally, please avoid using long cables to connect the modules as much as possible.

I/O Voltage

Table 3-3

VDD=3.3 V, GND =0 V,T=25℃

Parameter	Description	Minimum	Typical	Maximum	Unit
VIL	input low level	-	-	0.8	V
VIH	input high level	2	-	-	V
VIL (1)	input low level	-	-	2.2 (VDD-1.1)	V
VIH (1)	input high level	2.9 (VDD-0.4)	-	-	V
VOL	output low level		-	0.4	V
VOH	output high level	2.4	-		V

Trigger Function Reference Circuit

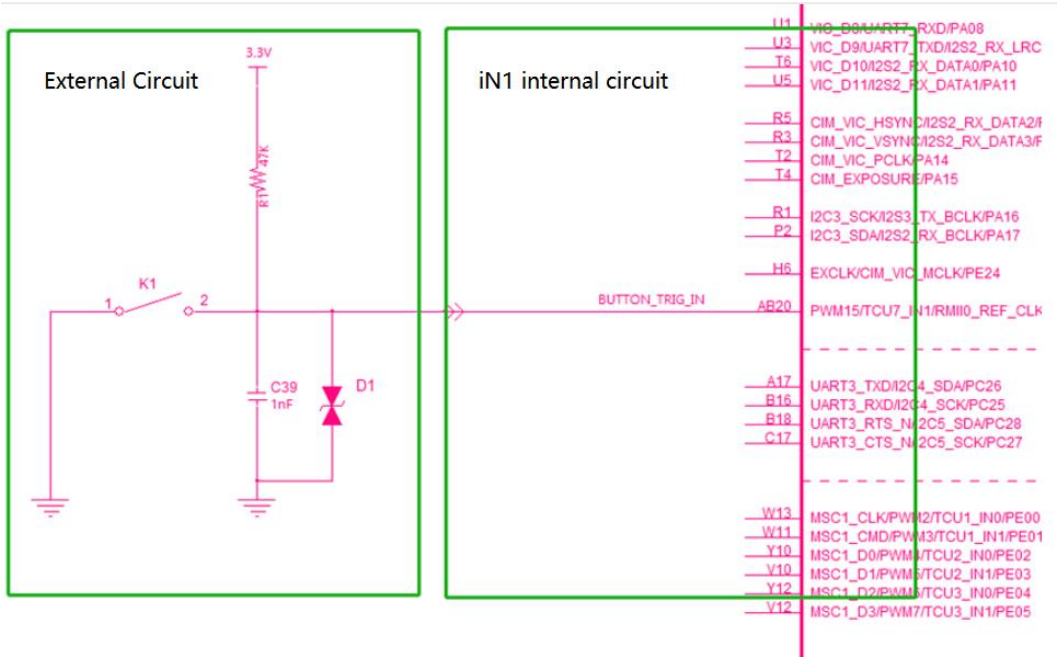
Figure 3-1 provides a circuit reference design of the trigger function, which is used to provide an effective trigger signal level to the module to make it generate a reading action.

The left part of the figure is the driving signal BUTTON_TRIG_IN on the module board.

In the application, only the reference design on the right part is used.

The BUTTON_TRIG_IN signal comes from Pin 12 on the 12 PIN-FPC,please refer to the previous part in Table2-1.

Figure 3-1



External Fill Light Control Reference Circuit

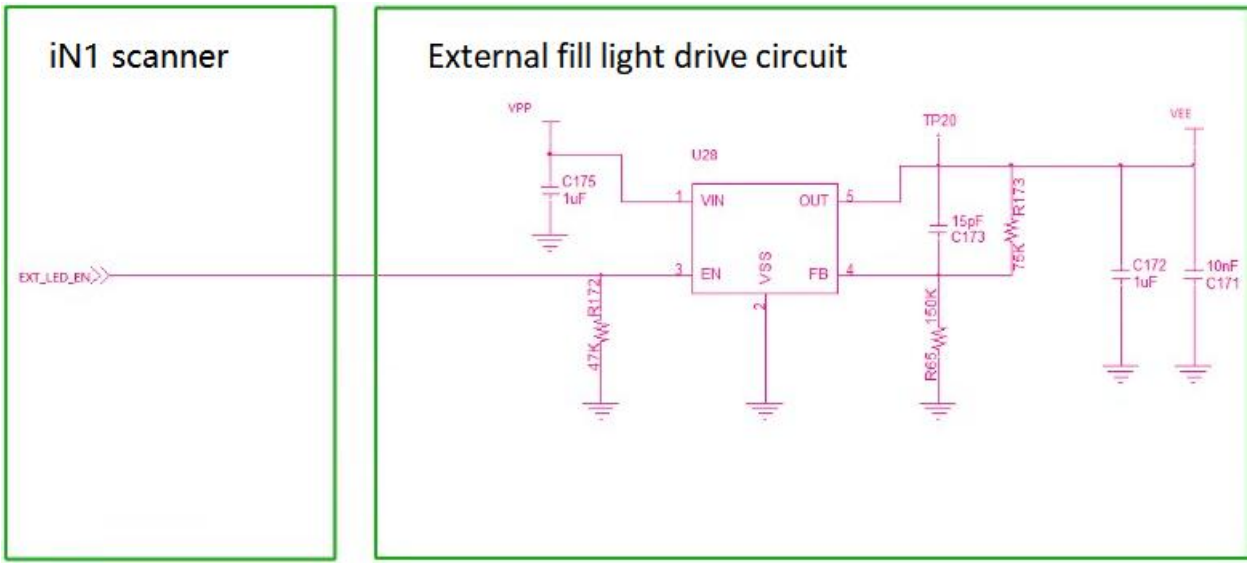
Pin 8 EXT_ LED _EN(In the module 12 Pin interface in Table 4-1) is the control signal of the external supplementary light, and the I/O is Floating state.

When the external fill light function is disabled , this I/O has been configured as an input pin.

When this function is enabled, the I/O is an output (Output) pin in the continuous working mode, and an input pin (Input) will be in the sleep state.

You may contact us before connecting external fill light.

Figure 3-2


iN1 scanner
External fill light drive circuit
VPP
C175
1uF
U28
VIN
OUT
EN
VSS
FB
TP20
VEE
15pF
C173
R173
75K
C172
1uF
10nF
C171
EXT_LED_EN
R172
47K
R65
150K

Interface Pinouts

The iN1's FPC comes out with 12pins to host.

The physical interface is a 12 -PIN FPC connector.

The 12-PIN FPC connector interface includes two communication forms: TTL-232 Communication form and USB communication.

As the below figure 4-1 shows, the 12 -PIN FPC connector is located at the right above corner of the decoding board, in which the pin order on the 12-PIN FPC is shown in the red marks.

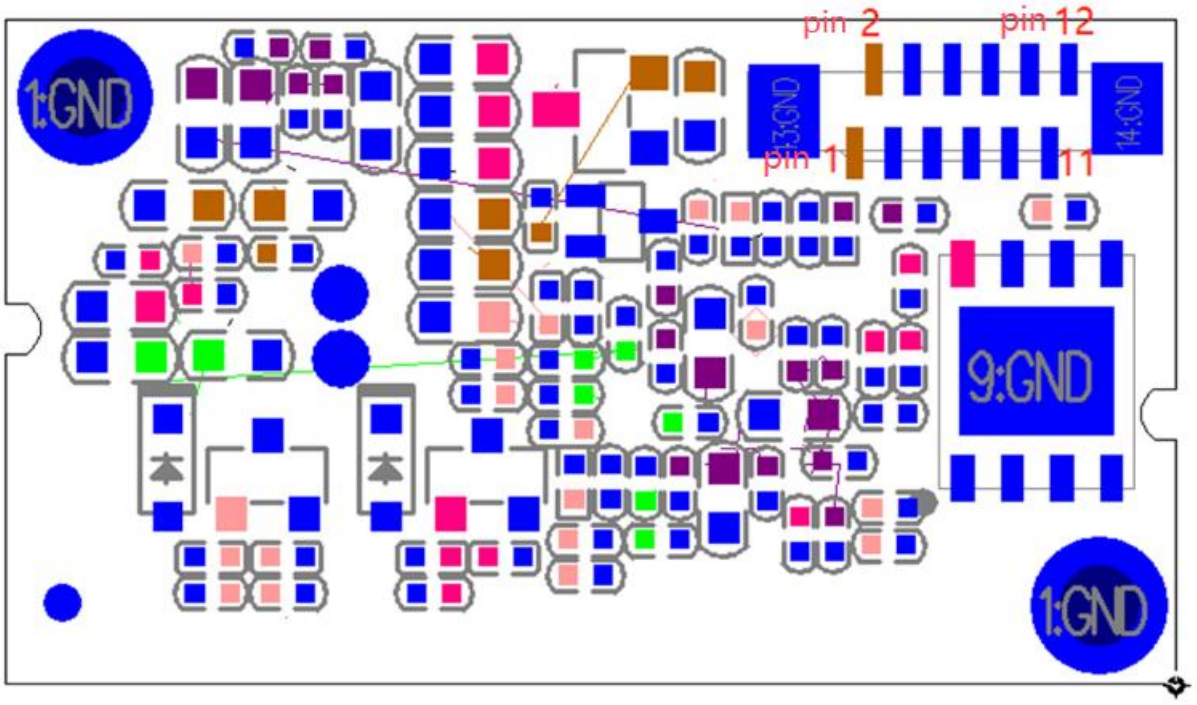


Figure 4-1

12-pin definition of pinout of iN1:

pin number	signal name	I/O type	default state	Functional description	Remark
1	VDD	power supply	-	3.3V power input	With 392mA peak current pulse
2	VDD	power supply		3.3V power input	
3	GND	land		power ground	
4	RXD _	input		TTL level 232 receive	
5	TXD _	output		TTL level 232 transmit	
6	USB_D -	input /output		USB_D - signal	

7	USB_D +	input /output	-	USB_D + signal	
8	EXT_LED_ EN	output-	-	External lighting control	
9	BUZZER	output	-	Buzzer output signal , highly effective	
10	LED_DEC ODE_SUC CESS	output	Internal drop-down -	Decoding successful indicator output signal, high effective	
11	RSTN_IN	input	-	Reset signal input	0: reset, 1: normal operation
12	BUTTON_ TRIG_IN	input	Internal pull-up-	Trigger input signal, low effective	

Table 4-1

Note:

1.The pin 12-- The BUTTON_TRIG_IN signal is taken directly from MCU pin , so the valid high and low levels of this pin are in the 3.3V domain . When designing an external control module, the user must refer to the IO level in the electrical characteristics--in the following part 4.

There are two trigger modes for external input : level trigger and pulse trigger.

Level trigger: The trigger signal can be input through an external button. For the external drive circuit, please refer to the part Trigger Function Reference Circuit--in the following part 5.

Pulse trigger: The effective pulse width is not less than 50ms.

After the pulse signal is provided, it will last for a period of effective decoding time. If the code word is decoded within this time, it will stop immediately. If the code word is not decoded within the duration, it will continue until the end of the time. The time length can be set, please refer to the corresponding chapter of the user manual for details. When this pin is not used, it could be left floating;

2. When the external reset signal is input, the low-level hold time must be at least 10ms, otherwise the reset may be invalid. It could be suspended;

3. LEDs have only one indication of successful decoding:

When the decoding is successful, a high level is output for a duration of 20ms, which is the default duration. Other durations can be set by scanning the code, please refer to the user manual for details. For the hardware external drive circuit, please refer to Figure 4-3 Good Read LED Circuit. When this pin is not used, it could be left floating.

Connector Specifications

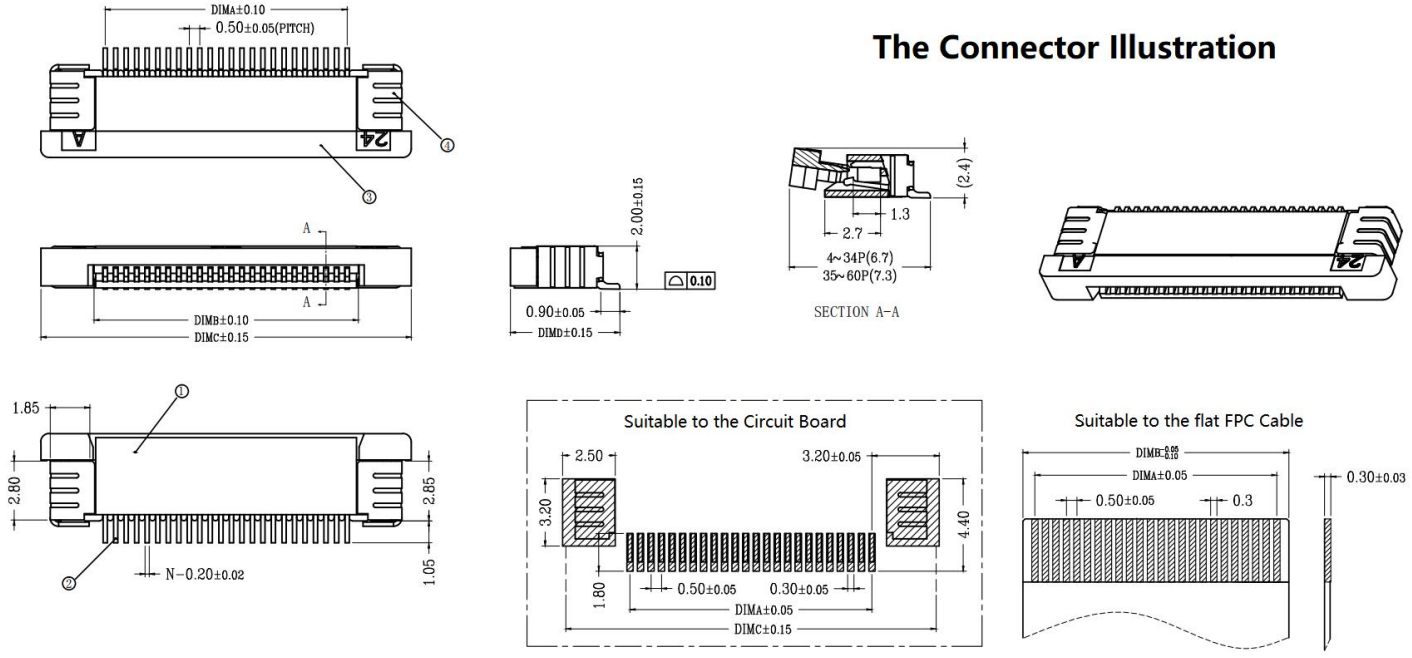


Figure 4-2

External Circuit Design

Good Read LED Circuit

Figure 5-1 provides the external circuit reference design shown in LED_DECODE_SUCCESS , which is used to realize the LED prompt function.

The left part of the picture is the driving signal LED on the decoder board.

You only need to use the reference design on the right part in the application. The LED_DECODE_SUCCESS signal comes from Pin 10 on the 12 PIN-FPC connector .

The power supply voltage of the indicator light should be selected reasonably.

Do not exceed the Vceo which is within the tolerance of the selected transistor .

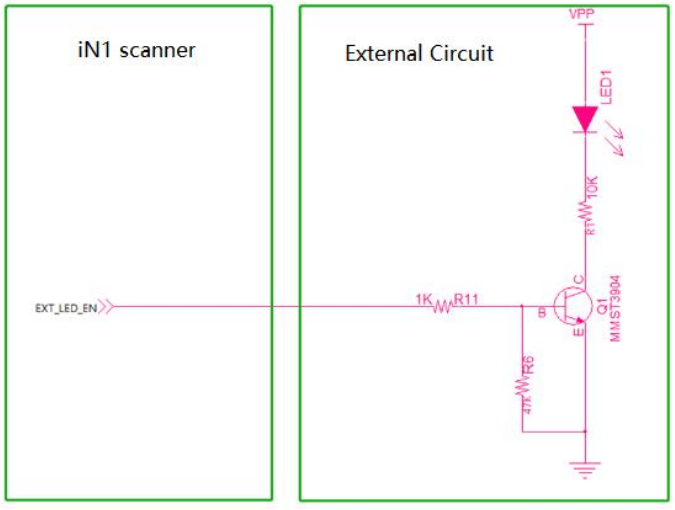


Figure 4-3

Beeper Circuit

The circuit below is used to drive an external beeper.

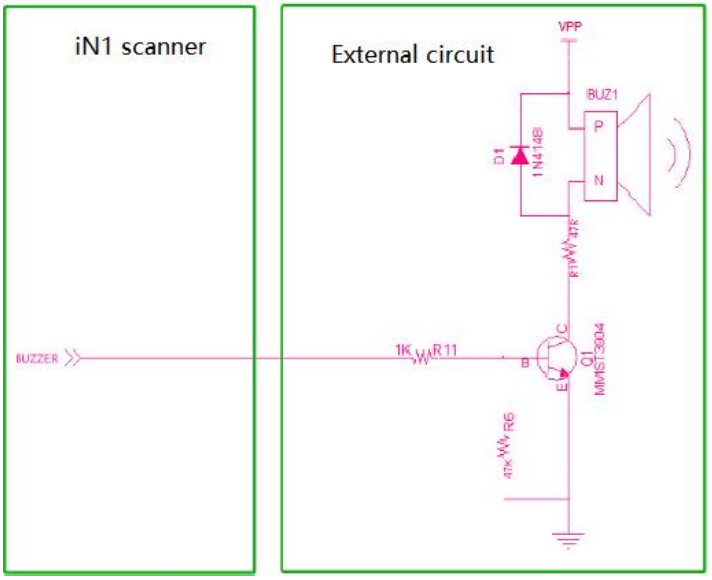


Figure 4-4

Figure 4-4 provides the reference design of the external circuit of the buzzer, which is used to realize the sounding function of the buzzer.

The left part of the figure is the control signal BUZZER on the decoder board. You only need to use the reference design on the right part in the application.

For the PWM output frequency and buzzer selection suggestions, please refer to the notes in Table 4-1.

Trigger Circuit

Figure 5-1 provides a circuit reference design of the trigger function, which is used to provide an effective trigger signal level to the module to make it generate a reading action.

The left part of the figure is the driving signal BUTTON_TRIG_IN on the module board.

In the application, only the reference design on the right part is used.

The BUTTON_TRIG_IN signal comes from Pin 12 on the 12 PIN-FPC,please refer to the previous part in Table 4-1.

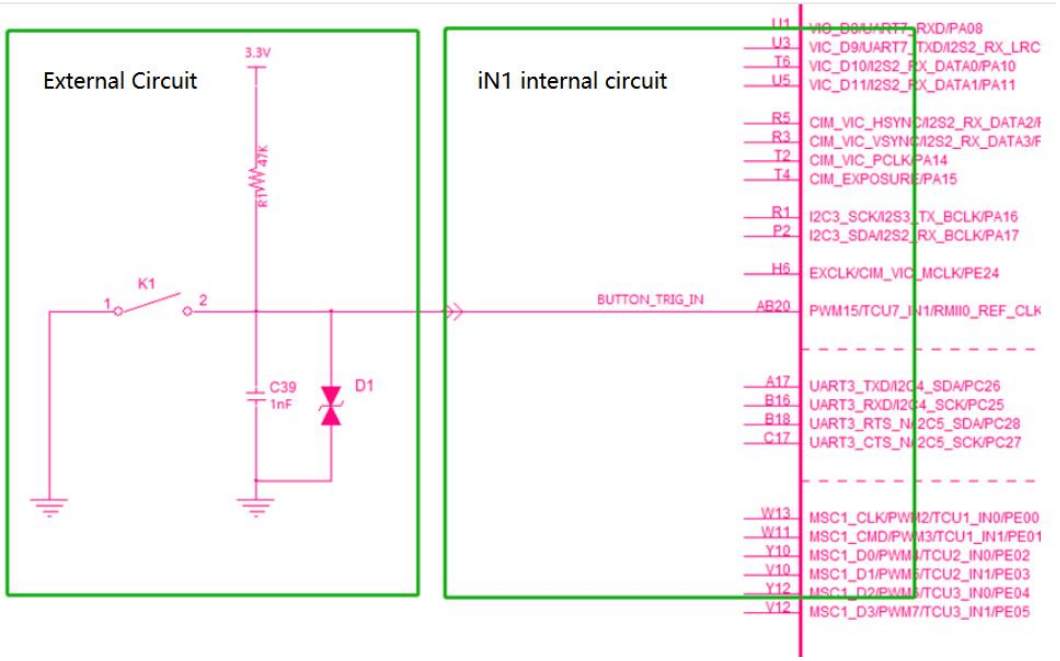

External Circuit
3.3V
47K
K1
1
2
C39
1nF
D1
iN1 internal circuit
BUTTON_TRIG_IN
U1
U3
T6
U5
R5
R3
T2
T4
R1
P2
H6
AB20
A17
B16
B18
C17
W13
W11
Y10
V10
Y12
V12
MSC1_D3/PWM7/TCU3_IN1/PE05

Figure 5-1

EVK

The EVK is provided to help users to test and evaluate the iN1, which contains beeper & beeper driver circuit, LED & LED driver circuit, and trigger, TTL-232 to RS-232 converter, RS-232 or USB interfaces, reserved signal debugging interface, etc.

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