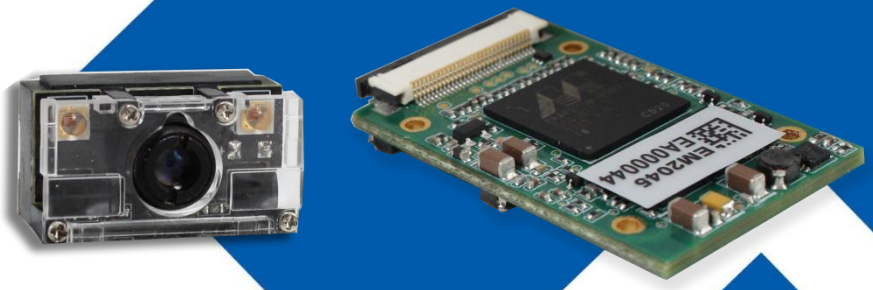
Newland

NLS-EM2045 Series

Embedded 2D Barcode Scan Engine

Integration Guide



Disclaimer

Please read through the manual carefully before using the product and operate it according to the manual. It is advised that you should keep this manual for future reference.

Do not disassemble the device or remove the seal label from the device. Otherwise, Fujian Newland Auto-ID Tech. Co., Ltd. does not assume responsibility for the warranty or replacement.

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Revision History

Version	Description	Date
V1.0.0	Initial release.	November 4, 2013

Table of Contents

Chapter 1 Introduction

About EM2045

EM2045 is a miniature embedded 2D Barcode Scan Engine armed with CMOS technology and Newland`s UIMG®. It can read barcodes on a variety of mediums like paper and magnetic cards and is suitable to be integrated into various sophisticated and space-constrained OEM devices.

The EM2045's high-performance CPU, in conjunction with supplied APIs and SDK, provides greater ease in application development.

Aimer

The EM2045 has a view finder that projects an aiming beam to help the user to position the target barcode within the engine's field of view to increase scan efficiency. The aimer can be programmed On or Off. It is advisable to turn it on when scanning barcodes.

Illumination

The EM2045 has several red LEDs (wavelength: 620±10 nm) for supplementary lighting, making it possible to scan barcodes even in complete darkness. The illumination can be programmed On or Off.

The use of red light as illumination and the engine's lens imaging system designed to work better with red light result in that 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 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 EM2045 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 EM2045 must be sufficiently enclosed to prevent dust particles from gathering on the imager, circuit board and lens. 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 EM2045:

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

Thermal Considerations

Electronic components (such as CPU, CIS and LED) in the EM2045 generate heat during the course of their operation. Operating the EM2045 in continuous mode for an extended period may result in an increase by 30℃ in temperature inside the engine. When the ambient temperature is high, the image noise level may increase and the image quality may degrade.

Methods below are suggested so as to reduce power consumption and heat build-up:

- ✧ Avoid constant use of the LEDs for prolonged periods.
- ✧ Place a heatsink on top of the EM2045, or install the engine on a metal surface.
- ✧ Reserve sufficient space for good air circulation in the design.
- ✧ Avoid wrapping the EM2045 with thermal insulation materials such as rubber.

Installation Orientation

The EM2045's imager has two M1.4*2mm tapped holes (Fig. 2-1) on its bracket for mounting the imager with screws. Fig. 2-2 shows the front view of the imager after installation.

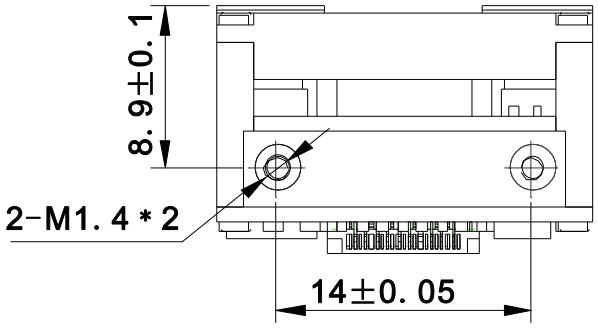

Fig. 2-1

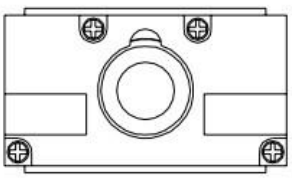

Fig. 2-2

Optics

Window Placement

The window on the imager (CM50) should be positioned properly to let the illumination and aiming beams pass through as much as possible and no reflections back into the imager (reflections can degrade the reading performance).

The window should be mounted close to the front of the imager (parallel). The maximum distance is measured from the front of the imager housing to the farthest 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 imager housing to the furthest surface of the window should not exceed 3mm and the distance from the front of the imager housing to the nearest surface of the window should not exceed 2mm.

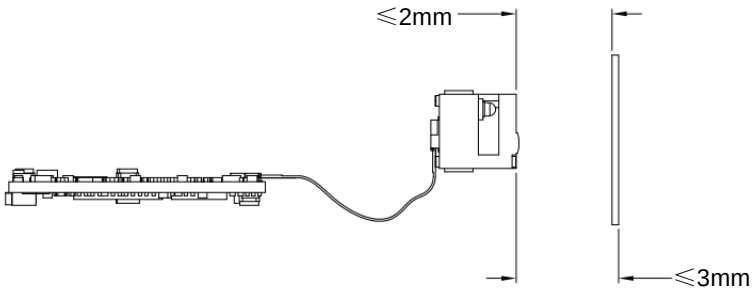

Fig. 2-3

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 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 EM2045. 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.

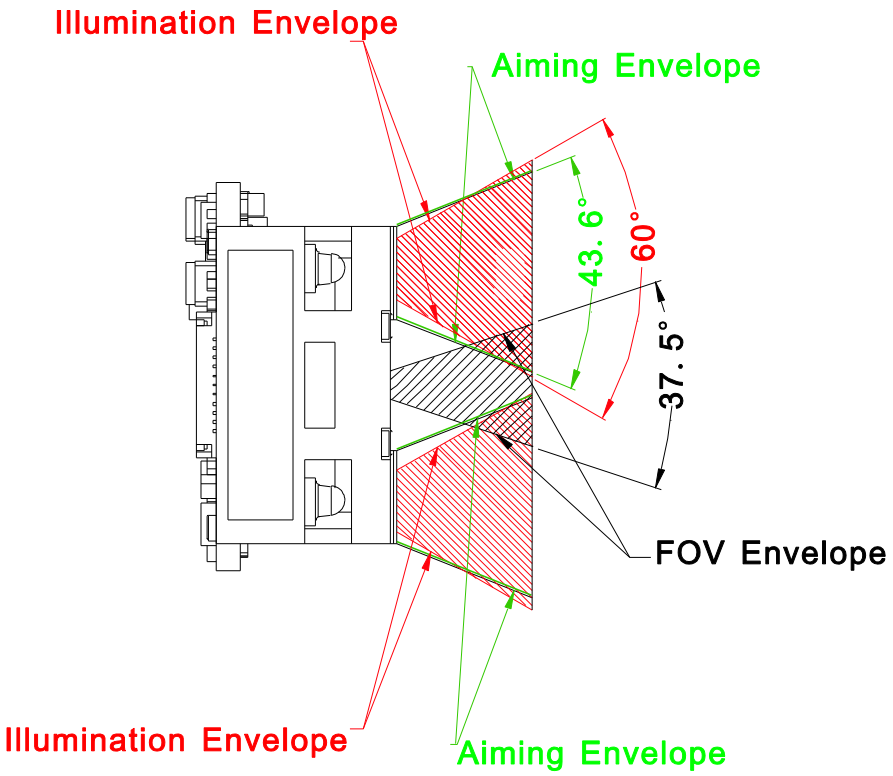

Fig. 2-4

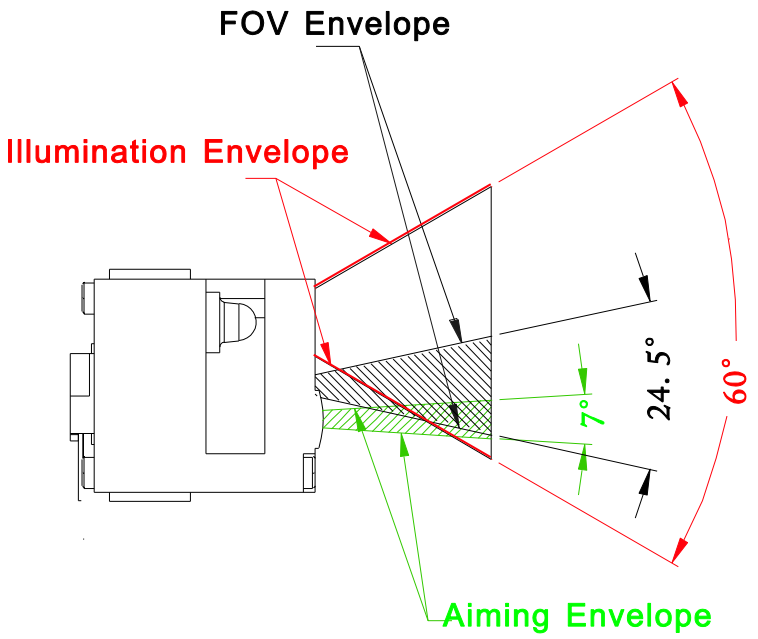

Fig. 2-5

Ambient Light

The EM2045 shows better performance with ambient light. However, high-frequency pulsed light can result in performance degradation.

Eye Safety

The EM2045 has 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 EM2045 consists of a decoder board (MB2045) and an imager (CM50) and uses a 21-pin flat flexible cable to connect these two parts.

When integrating the EM2045, the mechanical specifications below should be taken into consideration. The structure should be designed with enough space so that the decoder board and imager will not be oppressed by other components. And sufficient space should be kept for the location of flexible flat cable.

Imager (unit: mm)

Front View

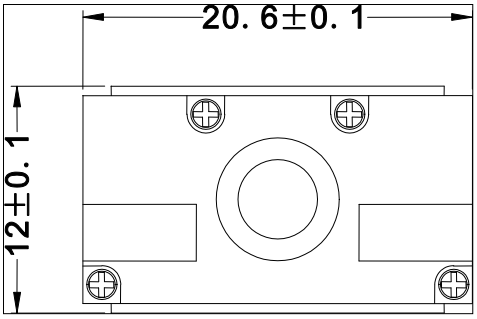

Fig. 2-6

Right View

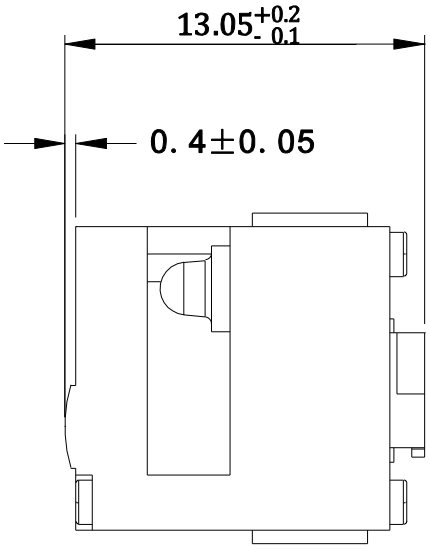

Fig. 2-7

Top View

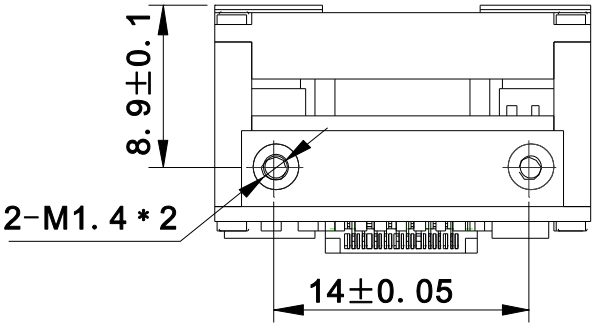

Fig. 2-8

Two screws (M1.4x2mm) should be used when mounting the imager. The dimensions and locations of the two mounting holes are illustrated in Fig. 2-8.

Decoder Board (unit: mm)

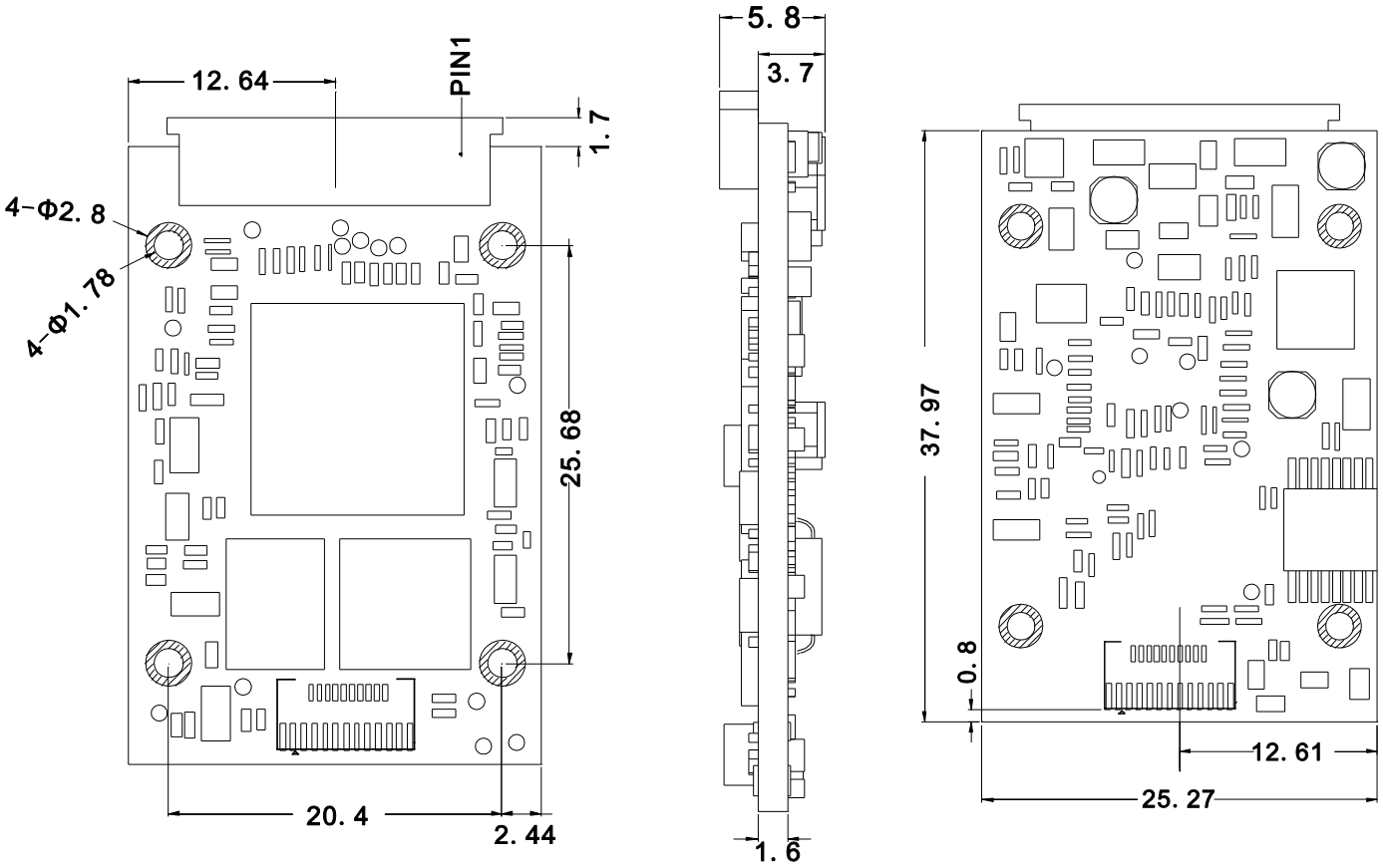

Fig. 2-9

Notes: Unless otherwise specified:

1. This is a reference drawing and is not intended to specify or guarantee all possible integration requirements for this decoder.
2. Tolerance for dimensions is ± 0.25 mm / ± 0.01 in.

Chapter 3 Electrical Specifications

Power Supply

Do not power up the EM2045 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 2s.

Ripple Noise

The image sensor is directly fed by the input power of EM2045. To ensure the image quality, a power supply with low ripple noise is needed.

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

Input Power

The EM2045 supports a wide range of operating voltage from DC3.0V to 5.5V. Users can choose input power within this range for their own system.

DC Characteristics

Voltage

TTL-232/RS-232: 3.0-5.5VDC; USB: 5.0VDC±5%

Ta=25℃

Input Voltage	Minimum (V)	Typical (V)	Maximum (V)
V_{DD}	3.0	3.3	3.6
V_{DD}	4.5	5.0	5.5

Current

Ta=25℃

Input Voltage (V)	Operating Current (mA)	Idle Current (mA)	Sleep Current (mA)
5.0	250	50	1.2
3.3	365	60	1.2

Chapter 4 Interfaces

The following table lists the pin functions of the 30-pin host interface connector.

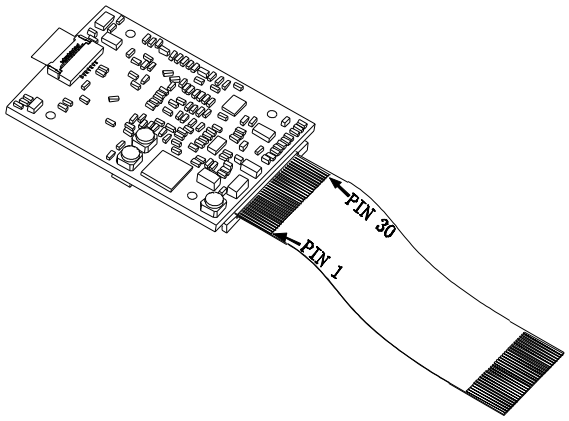

Fig. 3-1

PIN#	Signal Name	I/O	Description
1	HOST_DOWNLOAD	Input	Download signal: .low level indicates the EM2045 is ready to receive a new software image
2	HOST_3P3	Input	+3.3 V power supply
3	GND	-	System ground
4	HOST_RXD	Input	EM2045-00: RS-232 receive EM2045-01: TTL-232 receive
5	HOST_TXD	Output	EM2045-00: RS-232 transmit EM2045-01: TTL-232 transmit
6	HOST_CTS	Input	EM2045-00: RS-232 Clear To Send control signal EM2045-01: TTL-232 Clear To Send control signal
7	HOST_RTS	Output	EM2045-00: RS-232 Request To Send control signal EM2045-01: TTL-232 Request To Send control signal
8	POWER_DOWN	Output	Status signal from the EM2045 indicating power down state
9	BUZBEEPER_OUT	Output	Pulse width modulated output used to control an external beeper
10	HOST_DEC_LED	Output	Active low output used to indicate a valid bar code decode
11	HOST_AIM_WAKE*	Input	Signal functions as aiming pattern control when the EM2045 is not in a low power state Signal functions as a wakeup signal only when the EM2045 is in a low power state
12	HOST_TRIGGER*	-	Used to start a decode session
13	HOST_3P3	Input	+3.3 V power supply
14	GND	-	System ground
15	Reserved	-	
16	GND	-	System ground
17	Reserved	-	
18	HOST_3P3	Input	+3.3 V power supply
19	Reserved	-	
20	Reserved	-	
21	Reserved	-	
22	GND	-	System ground
23	HOST_USB_P	Input/Output	Positive differential data signal for the USB bus
24	HOST_USB_N	Input/Output	Positive differential data signal for the USB bus
25	GND	-	System ground
26	HOST_5V	Input	+5.0V power supply
27	HOST_5V	Input	+5.0V power supply
28	ILLUM_EN_OUT	Output	External illumination control signal
29	HOST_SYS_CFG0	Input	System configuration bits
30	HOST_SYS_CFG1	Input	

The following table lists the pin functions of the 21-pin imager (CM50) connector.

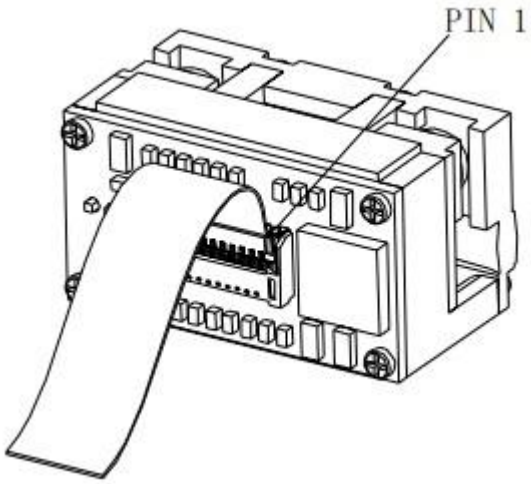

Fig. 3-2

PIN#	Signal Name	I/O	Description
1	GND	-	System ground
2	Reserved	Input/Output	Reserved，Recommends that users receive this pin GPIO pins on the microprocessor
3	GND	-	System ground
4	HSYNC (LINE_VALID)	Output	Line sync synchronized to a WVGA frame
5	VSYNC (FRAME_VALID)	Output	Vertical sync synchronized to a WVGA frame
6	Aimer On	Input	Focenable
7	Illumination On	Input	Illumination enable
8	Power Enable	Input	High level when CM50 work，Low level when CM50 get into Standby
9	I^2C_SDA	Input/Output	I^2C DATA
10	I^2C_SCL	Input	I^2CCLk
11	Vin_LED	Input	LED Power supply
12	D0	Output	Pixel data D0
13	Vin_Imager	-	SENSOR Power supply
14	D1	Output	Pixel data D1
15	D2	Output	Pixel data D2
16	D3	Output	Pixel data D3
17	D4	Output	Pixel data D4
18	D5	Output	Pixel data D5
19	D6	Output	Pixel data D6
20	D7	Output	Pixel data D7
21	PCLK	Output	Pixel clock used to synchronize the decoder to the pixel data

Connector

The host interface connector on the decoder board is a 30-pin FPC connector. The figure below illustrates the specifications (unit: mm) of the connector.

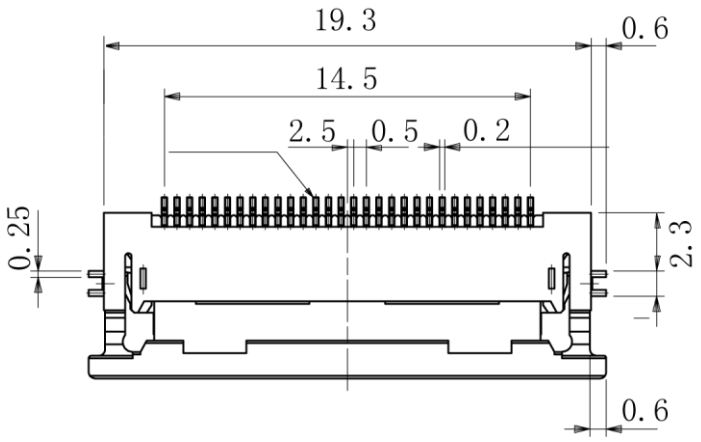

Fig. 3-3

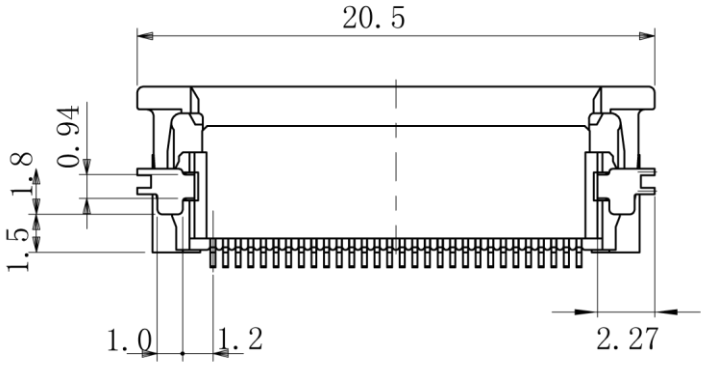

Fig. 3-4

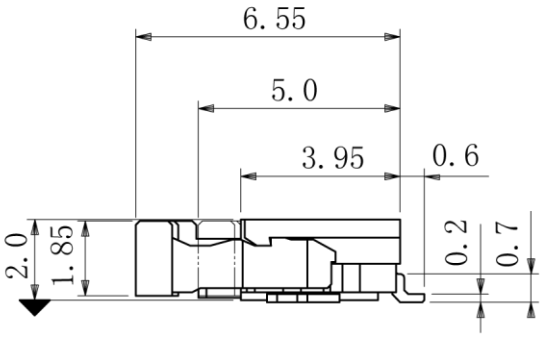

Fig. 3-5

The connector on the imager (CM50) used to connect to the decoder board is a 21-pin FPC connector. The figure below illustrates the specifications (unit: mm) of the connector.

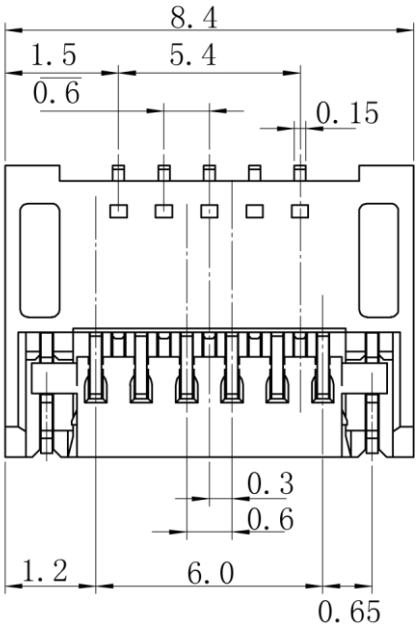

Fig. 3-6

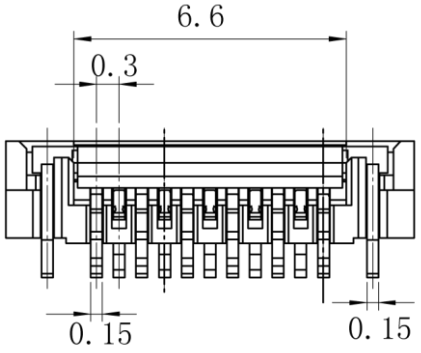

Fig. 3-7

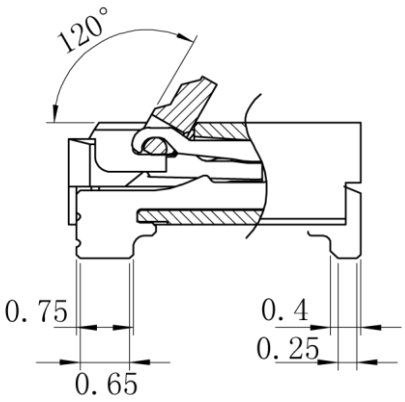

Fig. 3-8

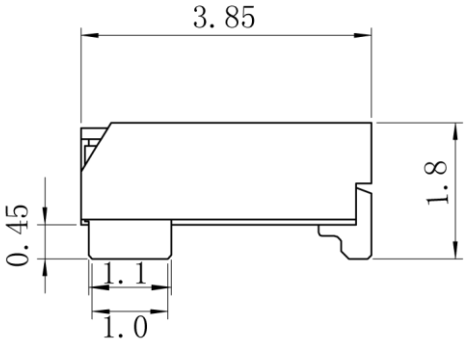

Fig. 3-9

Flat Flexible Cable

A 30-pin flat flexible cable (37mm long) can be used to connect the EM2045's decoder board to a host device. The cable design must be consistent with the specifications shown below. Use reinforcement material for the connectors on the cable and reduce cable impedance for reliable connection and stable performance.

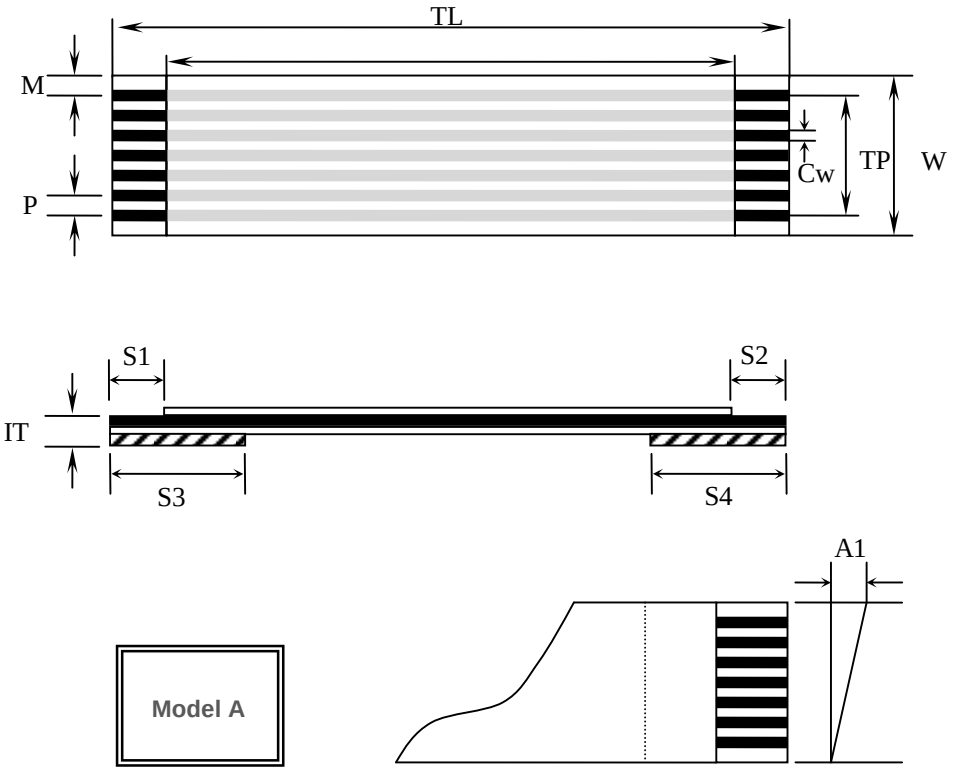

Fig. 3-10

Symbol	Item	Specification
C	Nunmber of Conductors	30P
P	Pitch	0.5±0.05mm
TP	Total Pitch	14.5±0.05mm
W	Width	15.5±0.07mm
M	Margin	0.5±0.05mm
L	Insulation Length	31±2.00mm
TL	Total Length	37±2.00mm
IT	Insuertion Thickness	0.30±0.05mm
INST	Insulation Thickness	0.12±0.02mm
S1/S2	Conductor Strip Length	3±1mm
S3/S4	Supporting Tape Length	4±1mm
Ct	Conductor Thickness	0.035±0.005mm
Cw	Conductor Width	0.3±0.02mm
A1	Slanting	0.50mm
Temperature: 15℃~25℃; Humidity: 30~60RH%		

A 21-pin flat flexible cable (55mm long) is provided for connecting the EM2045's imager (CM50) to its decoder board (MB2045). The following figure illustrates the specifications (unit: mm) of the cable.

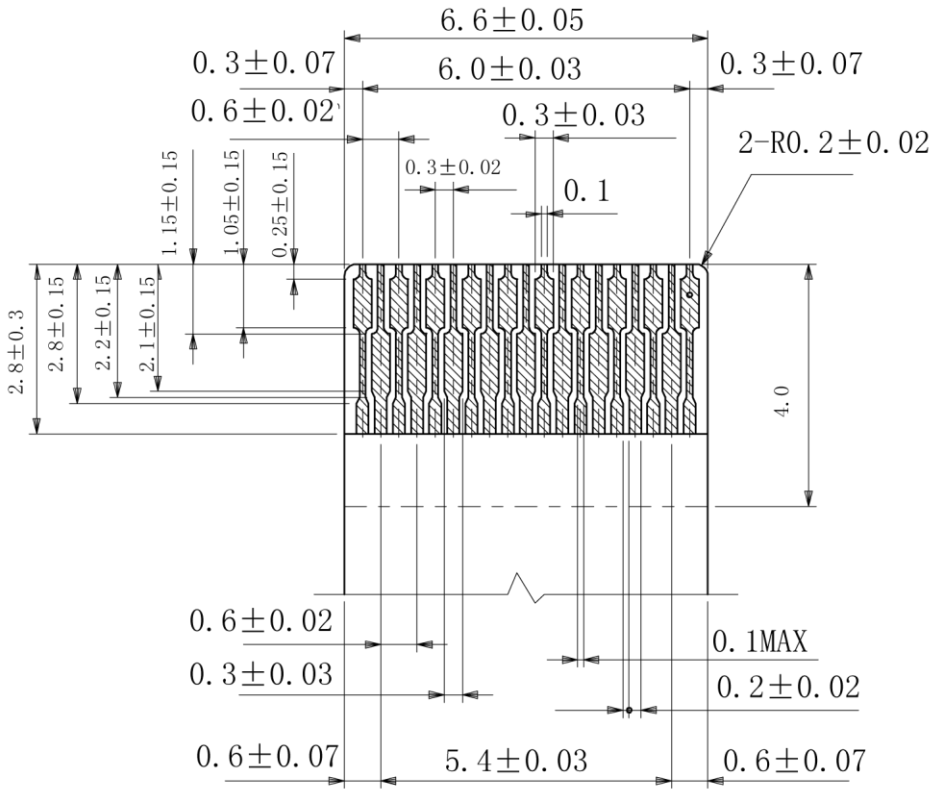

Fig. 3-11

Communication Interface

The EM2045 can communicate with the host device through USB (COM Port Emulation/HID-KBW/ DataPipe), TTL-232 (EM2045-01) or RS-232 (EM2045-00) interface.

The TTL-232/RS-232 interface on the EM2045 supports baud rates from 1200 bps to 115200 bps.

Control Interface

Wake-Up

Driving the HOST_AIM_WAKE pin (PIN 11) on the host interface connector low for 100us~500us before sending it high causes the EM2045 to restart.

Avoid restarting the EM2045 at short intervals. The minimum interval between two restarts should exceed 2s.

Trigger

Driving the HOST_TRIGGER pin (PIN 12) on the host interface connector low for a certain period of time causes the EM2045 to start a scan and decode session. The time period may differ from one scan mode to another. As for the level trigger mode that adopts image stabilization mechanism, driving this pin for 10ms or longer activates the engine to scan.

For some scan modes that implements timeout mechanism, decode session stops when the preset timeout occurs, even if the pin still remains low. After a decode session is completed, the HOST_TRIGGER pin needs to be sent high for 10ms or longer before the engine is getting ready for next trigger.

Beeper

The EM2045 provides a pin (BUZBEEPER_OUT, 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 or good decode. The PWM output is not strong enough to drive a beeper, thus an external beeper driver circuit is needed.

The following beeper driver circuit is provided for reference.

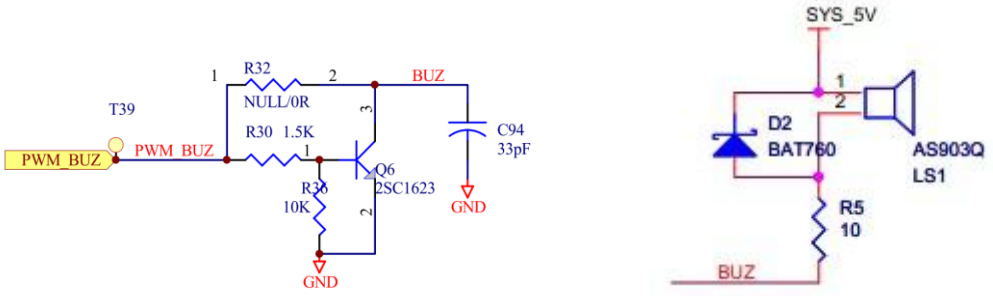

Fig. 3-12

Good Read LED

The EM2045 provides a pin (HOST_DEC_LED, PIN 10) on the host interface connector that provides an output to an external driver circuit for turning on an LED to indicate good read. When a good read is achieved, this pin turns from low to high and remains high for a while and then turns low. The output provided by the pin is not strong enough to drive an LED, thus an external LED driver circuit is needed.

The following LED driver circuit is provided for reference.

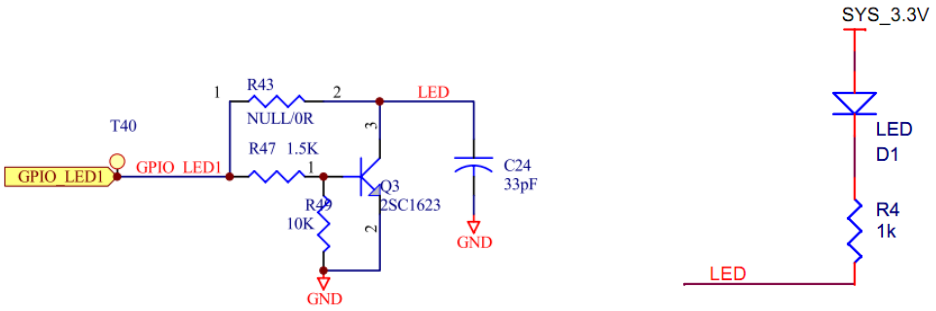

Fig. 3-13

Chapter 5 Development Tools

Software and hardware development tools as well as APIs are provided for engine performance evaluation, application development and engine configuration.

EVK

The EVK is provided to help users to test and evaluate the EM2045, 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 EM2045 can be connected to the EVK via a 30-pin flat flexible cable. 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 application development and function settings for the EM2045 under Windows.

Second Development Interface

The provided SDK and APIs allow integrators to conveniently create their own applications that can be run on the EM2045.

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