

**NLS-EM2096**  
**OEM Scan Engine**  
**Integration Guide**

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## Revision History

Version	Description	Date
V1.0.0	Initial release.	August 14, 2015
V1.0.1	Changed the operating current to 230mA, standby current to 8mA.	May 9, 2016
V1.0.2	Added the Mechanical Mounting Dimensions for Decoder Board and Connecting Imager to Decoder Board sections in Chapter 2.	March 7, 2017
V1.0.3	1. Modified the “Window Size” and “Mounting” sections in Chapter 2. 2. Modified the “DC Characteristics” section and added the “Timing Sequence” section in Chapter 3.	May 8, 2018



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# Chapter 1 Introduction

## Overview

The EM2096 OEM scan engine, armed with the Newland patented **UIMG**<sup>®</sup>, a computerized image recognition system, brings about a new era of 2D barcode scan engines.

The EM2096's 2D barcode decoder chip ingeniously blends **UIMG**<sup>®</sup> technology and advanced chip design & manufacturing, which significantly simplifies application design and delivers superior performance and solid reliability with low power consumption.

The EM2096 supports all mainstream 1D as well as PDF417, QR Code (QR1, QR2, Micro QR), Data Matrix, GS1-DataBar<sup>™</sup>(RSS) (Limited/ Stacked/ Expanded versions) and Chinese Sensible Code.

## Illumination

The EM2096 has two red LEDs for supplementary lighting, making it possible to scan barcodes even in complete darkness. The illumination can be programmed On or Off.

The EM2096 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.

## Aimer

The EM2096 has a view finder that produces a solid circle-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.

## Chapter 2 Installation

### General Requirements

#### ESD

ESD protection has been taken into account when designing the EM2096 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 EM2096 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 EM2096:

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 EM2096 will generate heat during the course of their operation. Operating the EM2096 in continuous mode 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 EM2096.

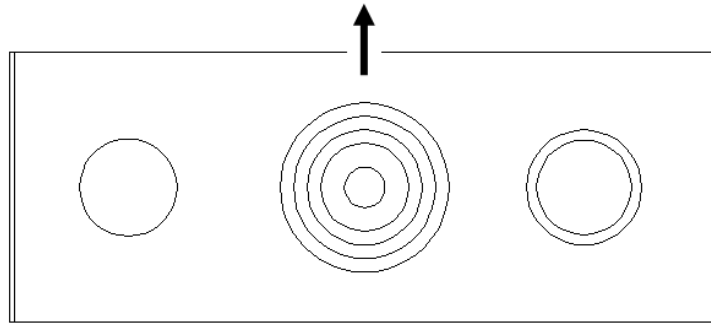
- ✧ Reserve sufficient space for good air circulation in the design.
- ✧ Avoid wrapping the EM2096 with thermal insulation materials such as rubber.



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## Installation Orientation

There are two threaded mounting holes in the bottom of the EM2096 for fastening the engine to a mounting surface with machine screws. The following figure illustrates a front view of the EM2096 after correct installation.



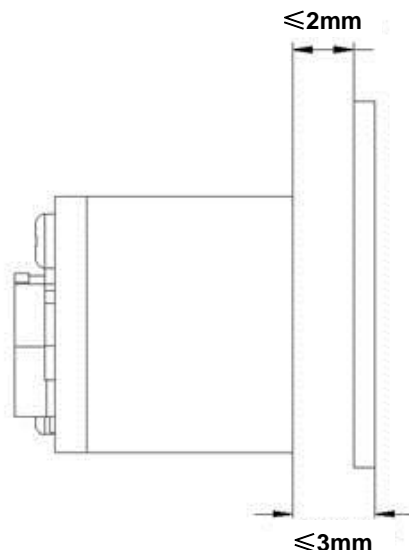
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## Optics

### 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. In order to reach better reading performance, 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

CIS's responsiveness (mainly to wavelengths of red light) should be taken into consideration when choosing window material and color, in order 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 red light over 90% and haze less than 1%. Whether to use an anti-reflection coating or not depends on the material and application needs.

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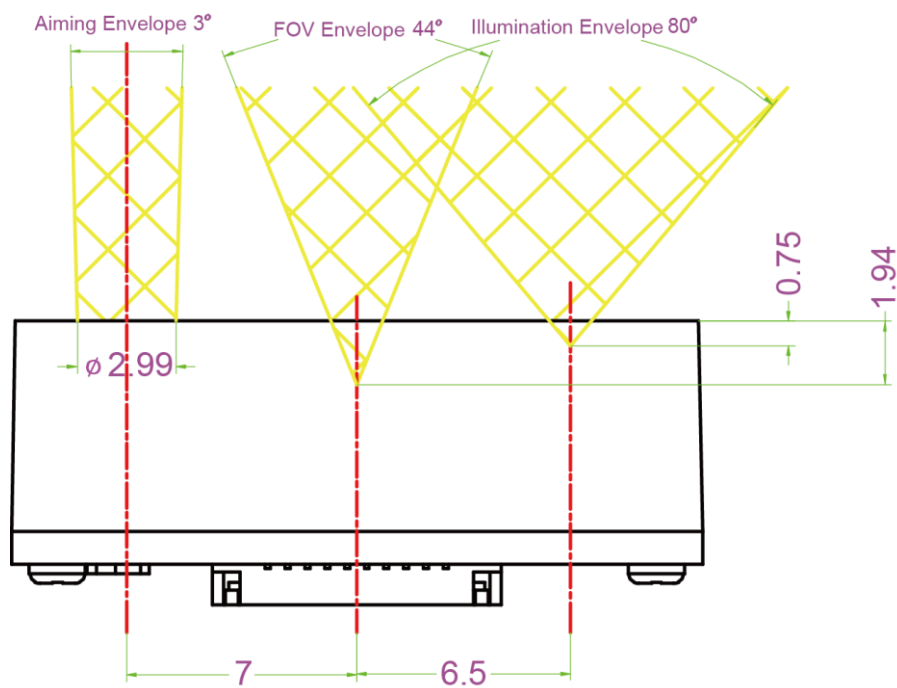
## Scratch Resistance and Coating

Scratch on the window can greatly reduce the performance of the EM2096. It is suggested to use abrasion resistant window material or coating.

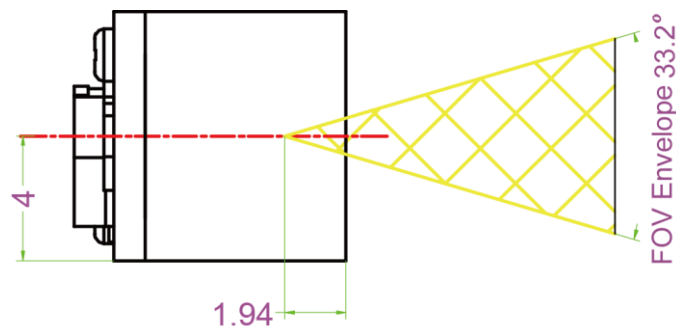
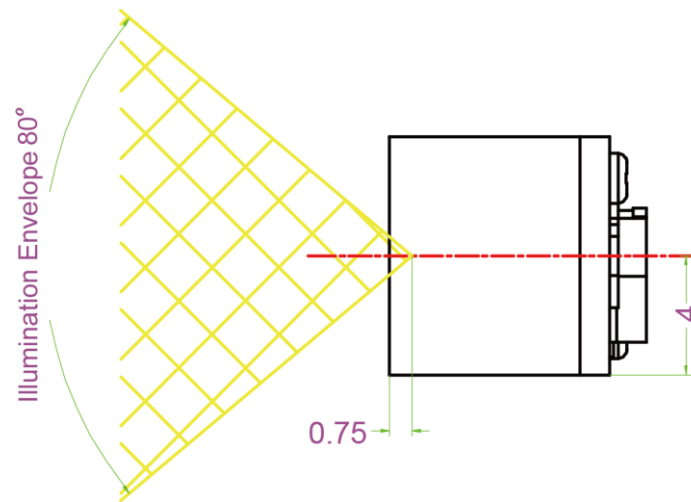
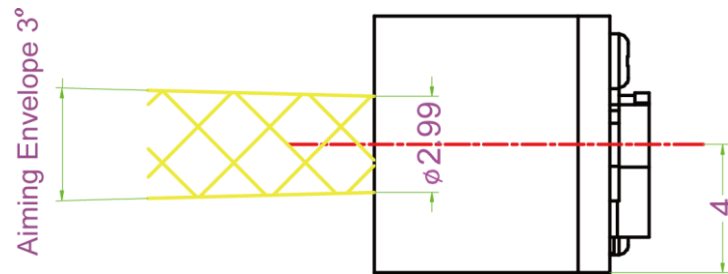
## Window Size

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

### Horizontal:



Vertical:



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## Ambient Light

The EM2096 shows better performance with ambient light and it is well able to handle the flicker in fluorescent lights using 50-60Hz AC power. However, high-frequency pulsed light can result in performance degradation.

## Eye Safety

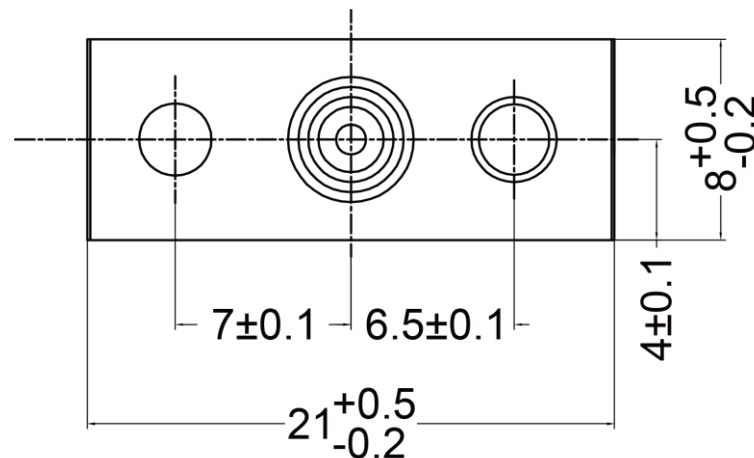
The EM2096 has no lasers. It uses red LEDs to create illumination and aiming beams. The LEDs are bright, but testing has been done to demonstrate that the engine is safe for its intended application under normal usage conditions. However, the user should avoid looking into the beam.

## Mounting

The illustrations below show the mechanical mounting dimensions for the EM2096. The structural design should leave some space between components.

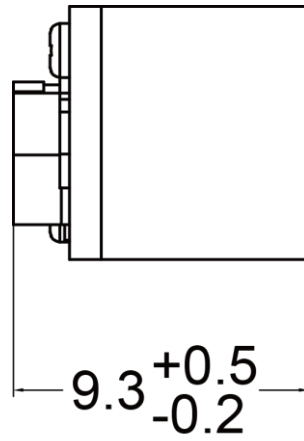
### Mechanical Mounting Dimensions for Imager (Unit: mm)

#### Front View

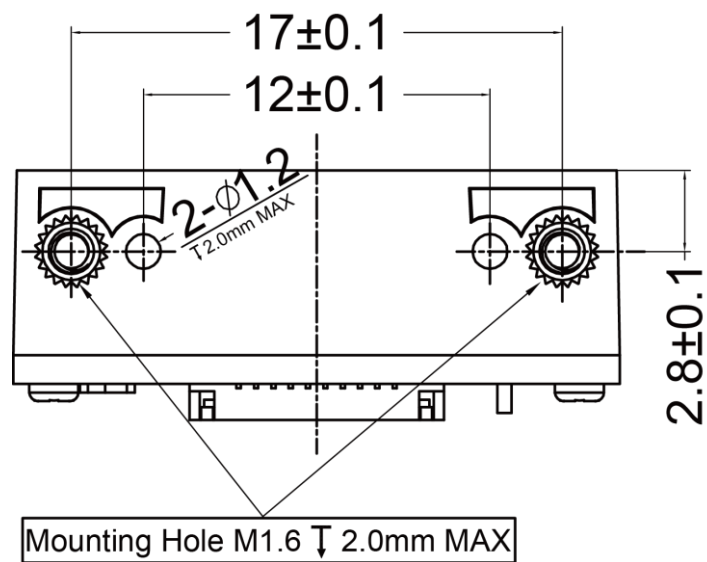


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Side View



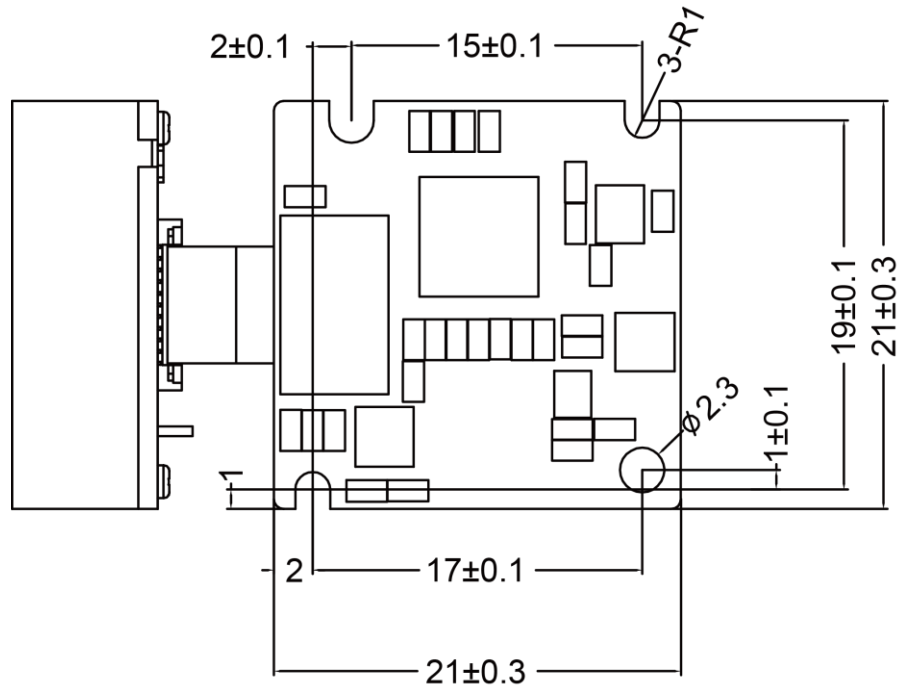
Top View



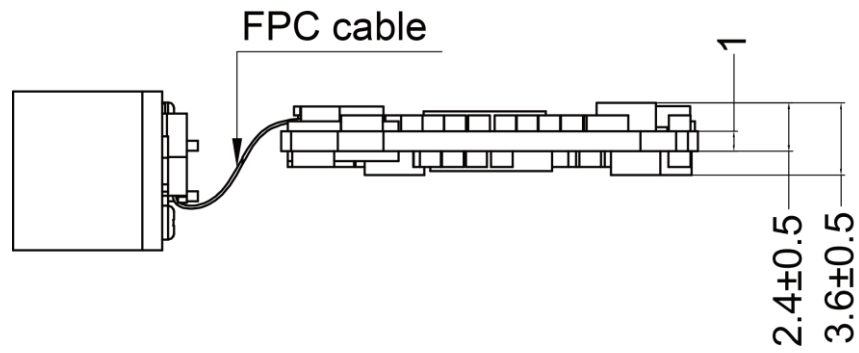
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## Mechanical Mounting Dimensions for Decoder Board (Unit: mm)

### Front View



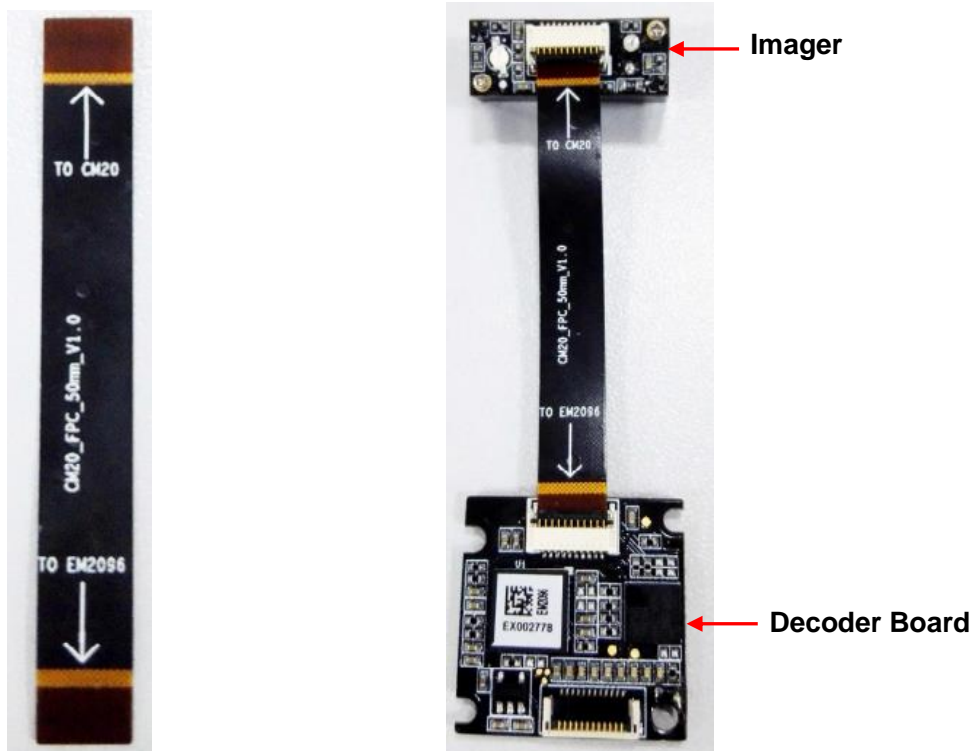
### Side View



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## Connecting Imager to Decoder Board

The EM2096 consists of two separate components — an imager and a decoder board. The imager should be connected to the decoder board with a 21-pin FPC cable as shown below.





## Chapter 3 Electrical Specifications

### Power Supply

Do not power up the EM2096 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

Image sensor and decoder chip are directly fed by the input power of EM2096. To ensure the image quality, a power supply with low ripple noise is needed.

Acceptable ripple range (peak-to-peak) :  $\leq 50\text{mV}$  ( $\leq 30\text{mV}$  recommended).

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## DC Characteristics

### Operating Voltage

Ta=23°C

Parameter	Description	Minimum	Typical	Maximum	Unit
V <sub>DD</sub>	Voltage Drain Drain	3.15	3.3	3.5	V
V <sub>IH</sub>	High Level Input Voltage	V <sub>DD</sub> -0.5	-	-	V
V <sub>IL</sub>	Low Level Input Voltage	-	-	0.5	V
V <sub>OH</sub>	High Level Output Voltage	V <sub>DD</sub> -0.3	-	-	V
V <sub>OL</sub>	Low Level Output Voltage	-	-	0.3	V

### Operating Current

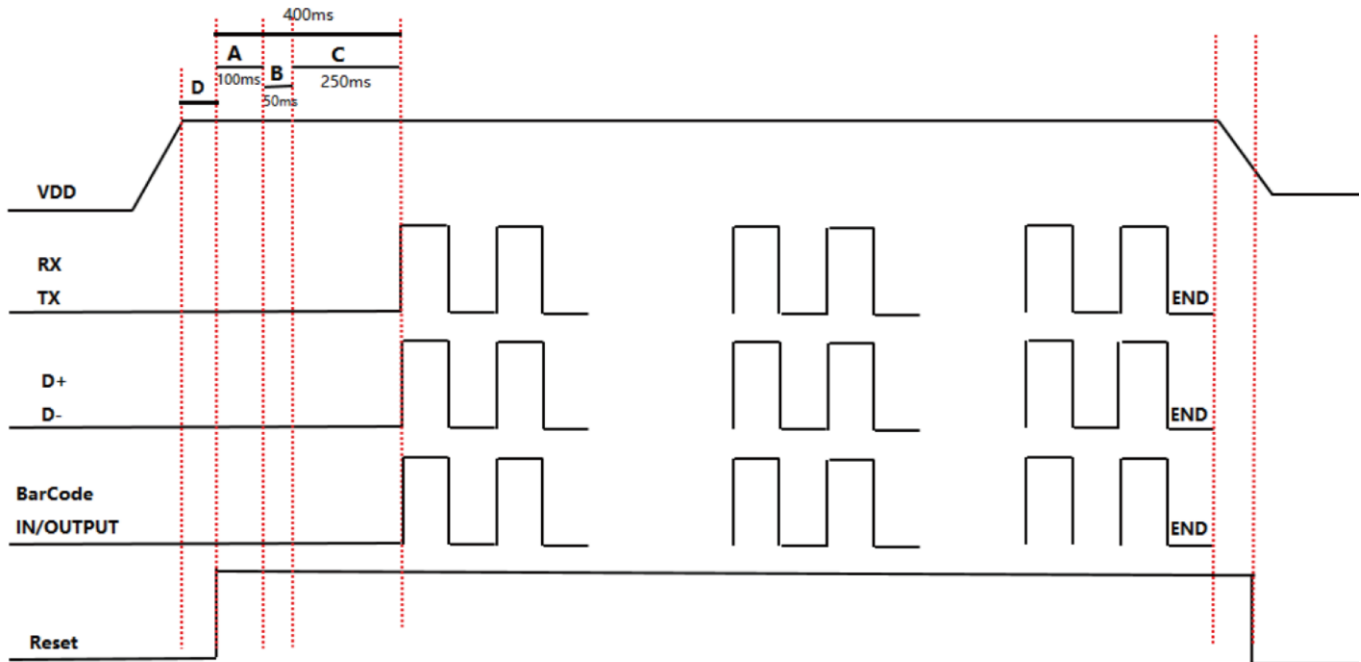
Ta=23°C, V<sub>DD</sub>=3.3V

Operating Current	Standby Current	Sleep Current
190mA (typical) 227mA (max.)	10mA	<10uA

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## Timing Sequence

The following diagram indicates the typical timing for the Power-up sequence of the engine.



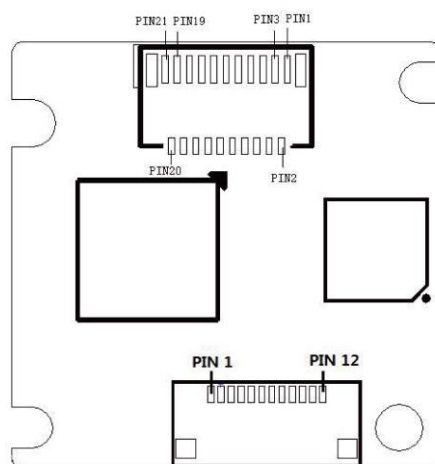
### Notes:

1. In the diagram above, it takes about 400ms for the engine to power up: **A** - time needed to choose the boot mode; **B** - time needed to boot the kernel; **C** – time needed to initialize decoder chip.
2. In the diagram above, **D** shows the reset time. If no additional operation is performed to manipulate the Reset signal, the power-up time can be measured from the point when VDD reaches 3.3V.
3. Before powering off the engine, ensure that data transmission via its communication interface(s) is complete to prevent transmission errors.
4. Before powering on the engine, ensure that all the signals remain low to prevent current from flowing backwards to affect the performance of the engine.

## Chapter 4 Interfaces

### Host Interface Connector

The following table lists the pin functions of the 12-pin host interface connector of the EM2096.

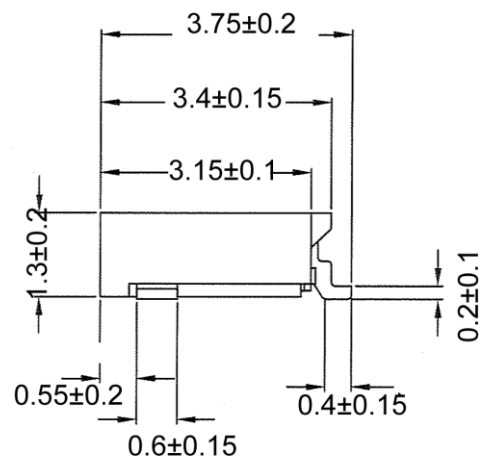
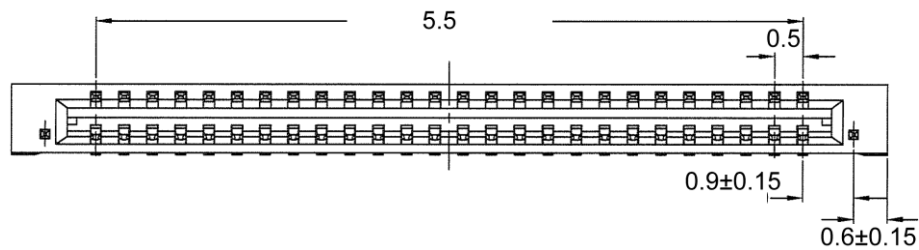
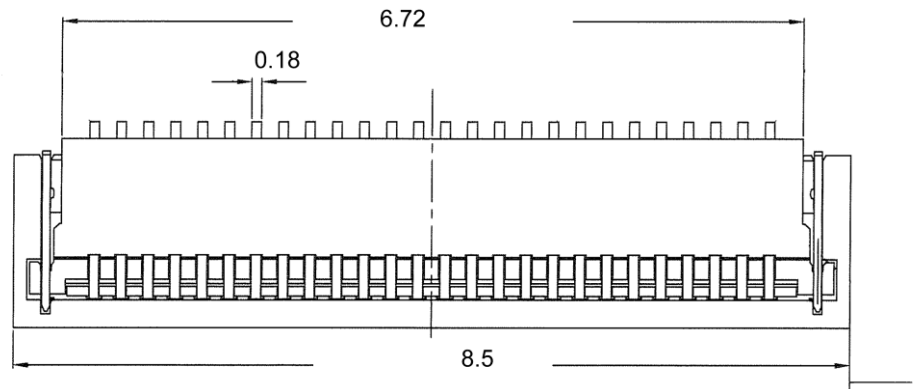


PIN#	Signal	I/O	Description
1	NC	-	Not connected.
2	VDD	-	3.3V power supply.
3	GND	-	Power-supply ground.
4	RX	I	TTL level 232 receive data.
5	TX	O	TTL level 232 transmit data.
6	USB_D-	I/O	USB D- differential data signal.
7	USB_D+	I/O	USB D+ differential data signal.
8	NC	-	Not connected.
9	Buzz	O	Beeper output. For the information of external beeper driver circuit, see the <b>Beeper</b> section in this chapter.
10	LED	O	Good Read LED output. For the information of external LED driver circuit, see the <b>Good Read LED</b> section.
11	Reset	I	Reset signal input: Driving this pin low for 100us resets the engine.
12	nTrig	I	Trigger signal input: Driving this pin low for 10ms causes the EM2096 to start a scan and decode session.

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## Dimensions of the Host Interface Connector (unit: mm)

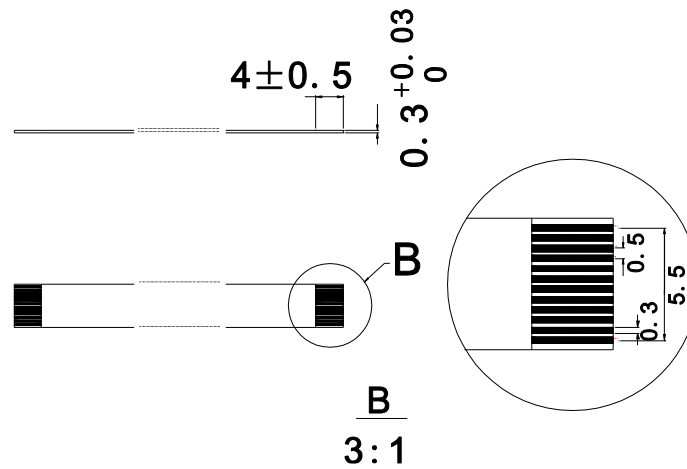
The EM2096 uses a 12-pin FPC ZIF socket (bottom contact, model: 10051922-1210EHLF) manufactured by FCI. The socket can be connected to a host device with an FFC cable.



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### FFC Cable (unit: mm)

A 12-pin FFC cable can be used to connect the EM2096 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.



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## Communication Interfaces

The EM2096 can communicate with the host device via its TTL-232 interface. This interface is applicable to most system architectures. For those requiring RS-232, a TTL-232 to RS-232 conversion circuit is needed.

The EM2096's TTL-232 interface supports baud rates from 1200bps to 115200bps; it does not support hardware flow control. Its default settings are 9600bps, 8 data bits, no parity check and 1 stop bit.

Besides, the EM2096 can also communicate with the host device via its USB interface (optional).

1. 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.
2. USB COM Port Emulation: The USB interface 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.
3. 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.

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## Control Interfaces

### Reset

Driving the Reset pin (PIN 11) on the host interface connector low for 100us-500us can reset the EM2096. However, do not reset the engine at unreasonably short intervals. The minimum interval between resets must exceed 2 seconds.

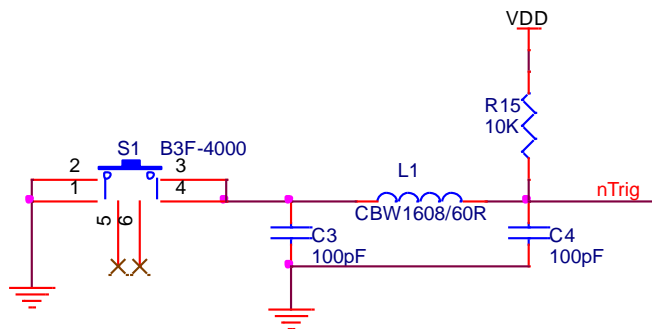
### Trigger

Driving the nTrig pin (PIN 12) on the host interface connector low for over 10ms causes the EM2096 to start a scan and decode session. If barcode is decoded, the EM2096 waits for the voltage at the nTrig pin to turn high (or the trigger to be released) after sending the data to the Host. If the trigger is released during a scan attempt, the EM2096 immediately stops decoding.

Next decode session does not happen until the EM2096 receives active trigger signal (driving the nTrig pin low) again.

As a decode session involves image capture, barcode decoding and other steps, it is suggested that the minimum interval between triggers should exceed 50ms.

The following trigger circuit is provided for reference.



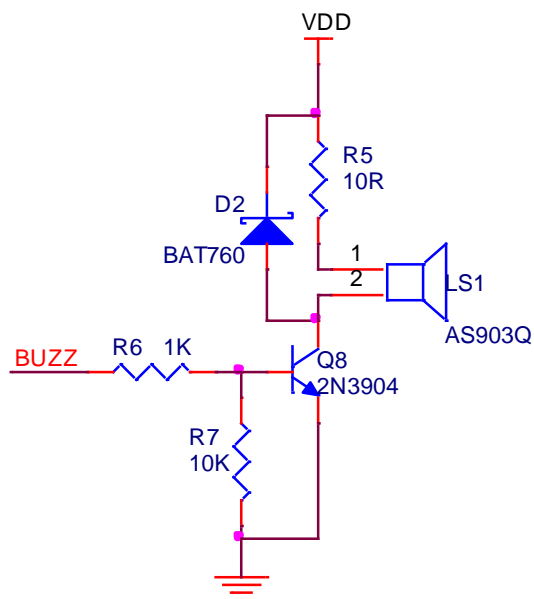


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## Beeper

The EM2096 provides a pin (Buzz, 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 read. The PWM output is not strong enough to drive a beeper, thus a beeper driver circuit is needed.

The following beeper driver circuit is provided for reference.

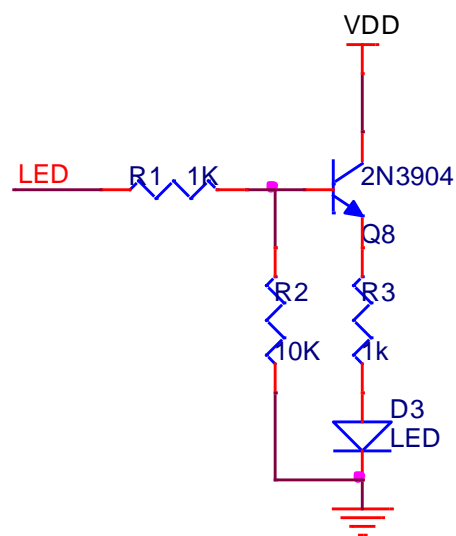


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## Good Read LED

The EM2096 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 LED pin produces a high level output and then the signal is 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 EM2096's development tools include both software and hardware and 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 EM2096, 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 EM2096 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 EM2096 under Windows.



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