



**EM2037 Series**  
**Embedded 2D Barcode Scan Engine**  
**Integration Manual**



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## **Revision History**

Version	Description	Date
V1.0.0	Initial release.	December 28, 2012
V1.0.1	Updates: Corrected inappropriate expressions and misspellings	January 17, 2013

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# Chapter 1 Introduction

## About EM2037

EM2037 is an embedded 2D Barcode Scan Engine with CMOS technology and Newland's **UIMG**. It can read barcodes on various carriers like paper and magnetic cards and is suitable to be integrated into various OEM devices including handheld scanners, PDA, kiosks, etc.

The image acquisition interface, initial data interface as well as I/O interface are available for users, which enables users to easily realize second development via Newland's SDK.

## Documents

Documents related to EM2037 include:

*NLS-EM2037 series Embedded 2D Barcode Scan Engine  
Integration Manual:*

Describe how to integrate EM2037

*NLS-EM2037 series Embedded 2D Barcode Scan Engine  
User Guide:*

Explain how to use and program  
EM2037

*Sample Barcodes:*

Sample barcodes for test

## Aimer

EM2037 provides a view finder that projects an aiming beam to help the user center the target barcode and improve efficiency. The aimer can be programmed on and off, but it is suggested to be turned on during scanning.

## Illumination

EM2037 has two red LEDs for supplementary illumination so as to enable the engine to scan barcodes even in complete darkness. The illumination can be programmed on and off.

Since the illumination is red light and the lens imaging system is coated by AR film which has obvious anti-reflection effect against red light, the engine shows better reading performance on non-red barcodes. For applications with red barcodes, it is suggested to adopt supplementary illumination lights of other colors.

## Chapter 2 Installation

### General Requirements

#### ESD Precautions

ESD has been taken into consideration during the design of EM2037 and the engine is shipped in ESD safe packaging. Use care when handling the engine outside its package. Be sure grounding wrist straps and properly grounded work areas are used.

#### Dust and Dirt

EM2037 must be sufficiently enclosed to prevent dust particles from gathering on the imager and lens. Dust and other external contaminants will eventually degrade the engine's performance.

#### Environment

Good operation of EM2037 requires environment to meet below standards:

Working Temperature	-20°C to 55°C
Storage Temperature	-40°C to 80°C
Humidity	5% ~95% (non-condensing)

#### Thermal Consideration

Care must be taken when designing the engine into any system. High-power components (like CPU, CIS, LEDs and PMIC) on EM2037 may cause internal heating in high duty cycle scanning applications. In a continuous scanning or high use circumstances, the engine sectional temperature can rise to 30°C. When the ambient temperature is high, the image noise level may be increased and the image quality may be degraded.

Methods below are suggested so as to reduce power consumption and heating:

- ✧ Avoid long term use of LEDs in continuous mode
- ✧ Reserve space for air convection during design.
- ✧ Avoid wrapping EM2037 with heat insulation materials like rubber.

#### Installation Orientation

Figure 2-1 illustrates the proper position and front view for installation of EM2037.

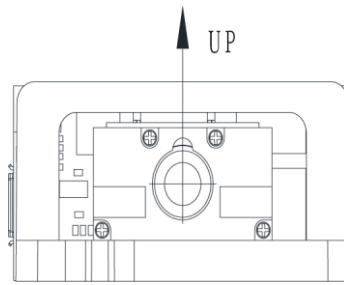


Figure 2-1

## Optics

### Window Placement

The window functions as an isolation wall in front of EM2037 to separate the engine from other parts of the entire device. Meanwhile the window placement should ensure that the illumination and aiming beams can come out and no reflection into the engine, otherwise the reading performance might be affected.

The window should be mounted close to the front of the engine (parallel, no tilt). The maximum distance is measured from the front of the engine housing to the farthest surface of the window. Avoid reflection of illumination beams back to the engine and adopt thin material for window so as to reach better reading performance. As shown below, the maximum distance should be no more than 3mm and the distance from the front of the engine housing to the nearest surface of the window should be no more than 2mm.

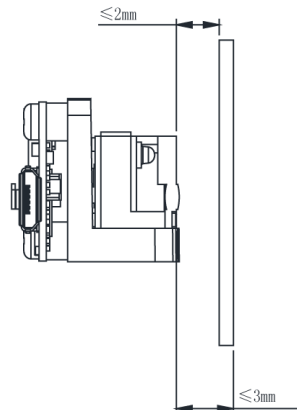


Figure 2-2

If the window is required to be placed tilt, the distance should meet the same requirements as placed parallel and the tilt angle should ensure no reflection back into the lens.

### Window Material and Color

The wave-length of illumination and aiming beams should be taken into consideration when choosing window material and color, so as to realize the possible highest transmission rate. The window should be

clear and has even refraction. It is suggested to use PMMA or optical glass with transmission rate over 90% and vagueness rate less than 1%. Whether coated or not depends on materials and application demands.

### Abrasion-resistant and Coating

Scratch on window will severely reduce the reading performance. It is suggested to use high-abrasion window material or use abrasion-resistant coating to prevent scratch and abrasion.

### Window Size

The primary requirement for window design is to ensure the window will not obstruct the field of view. Based on that, the less obstruction on illumination envelope the better. Window size diagrams are shown below for design reference.

#### Window Size Diagram

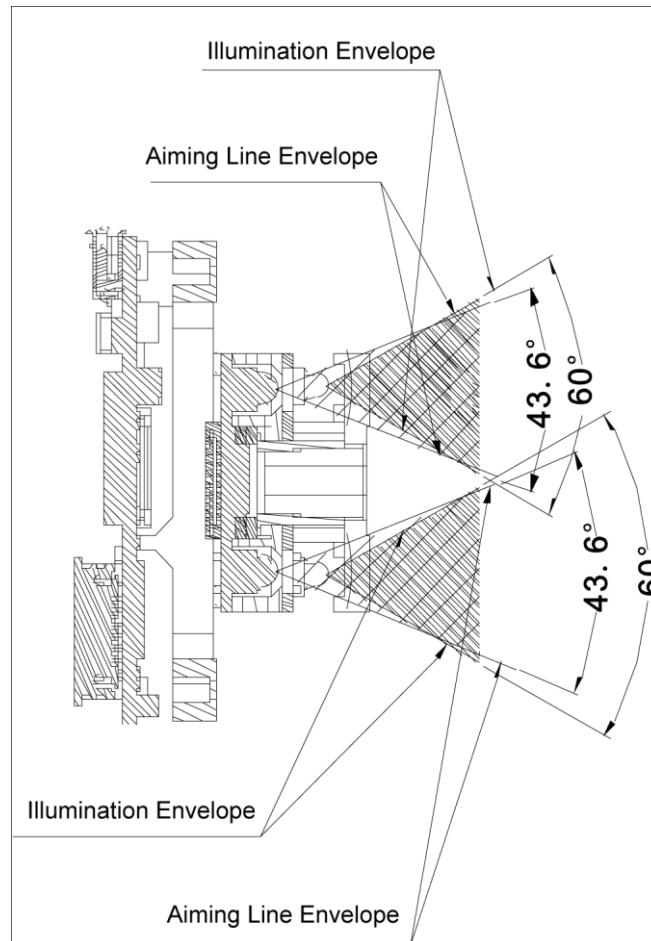


Figure 2-3 Crosswise Section

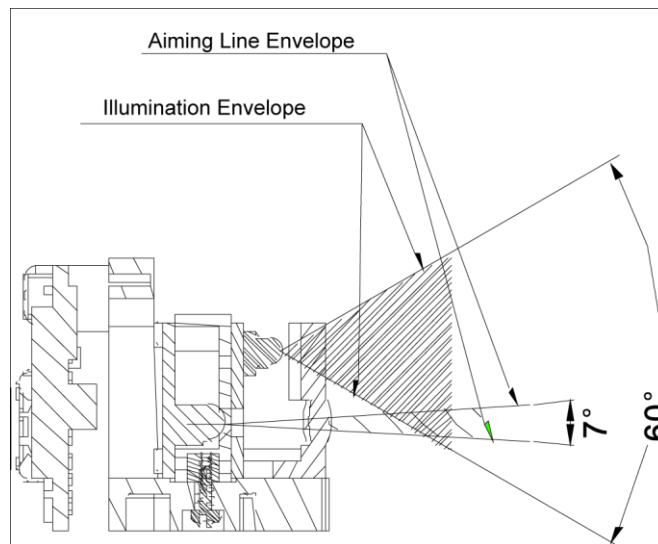


Figure 2-4 Longitudinal Section

### Optical Diagram of 37.5° Lens

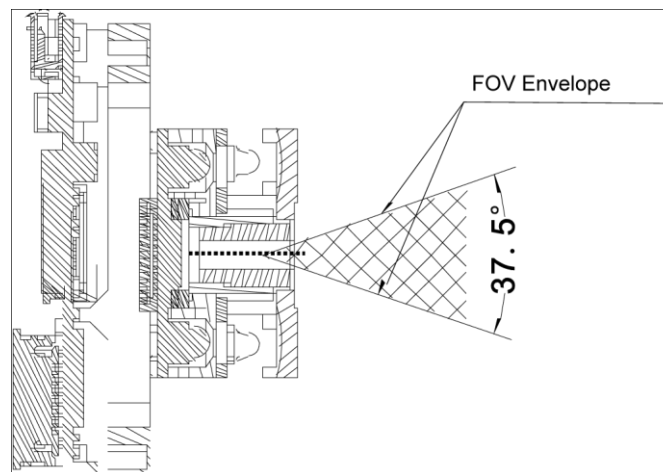


Figure 2-5 Crosswise Section

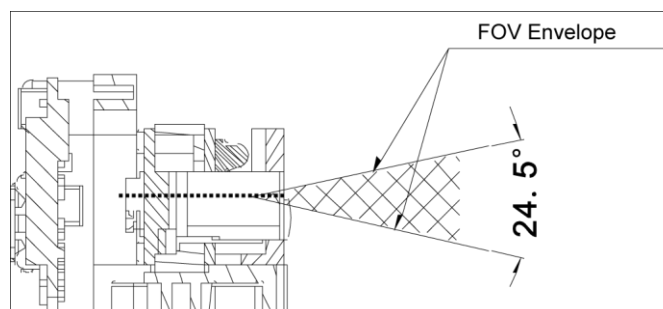


Figure 2-6 Longitudinal Section

### Optical Diagram of 42° Lens

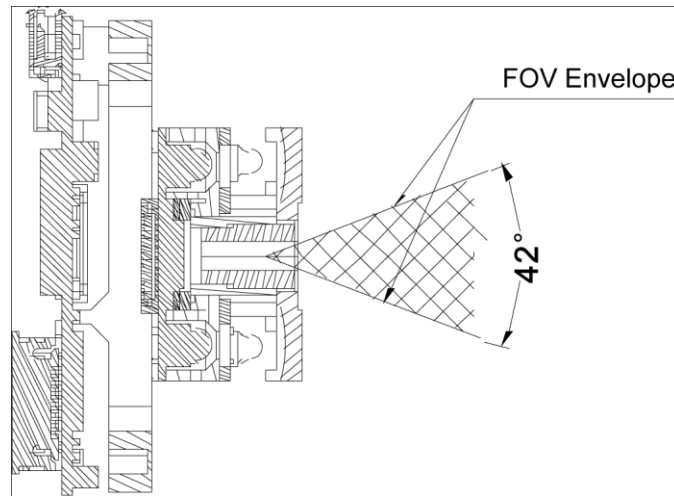


Figure 2-7 Crosswise Section

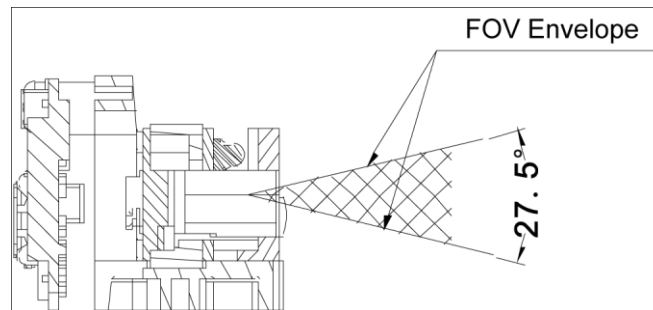


Figure 2-8 Longitudinal Section

## Ambient Light

EM2037 might show better performance with ambient light. For high-frequency impulse light, however, the reading might be interfered.

## Eye Safety

EM2037 adopts LEDs instead of laser for aiming and illumination. Such LEDs are safe to eyes in normal circumstances. However, direct look in the eye of such LEDs should be avoided during use.

## Mounting

The structure of EM2037 supports two kinds of integration, i.e. combined type and discrete type. For the combined type, the decoder board and the imager are originally fixed as a whole on an L shape bracket and thus the user can just mount the whole bracket on the target device. The combined type is easy for integration and is suitable for devices with enough space inside. For discrete type, the decoder board and the imager are separately mounted and are connected by flexible flat cable. The discrete type is more flexible for integration and suits devices with smaller space inside.

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

## Mechanical Mounting Dimensions for Combined Type (Unit: mm)

### Front View

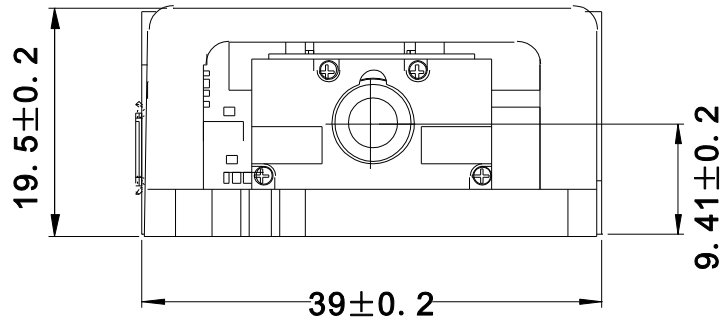


Figure 2-9

### Bottom View

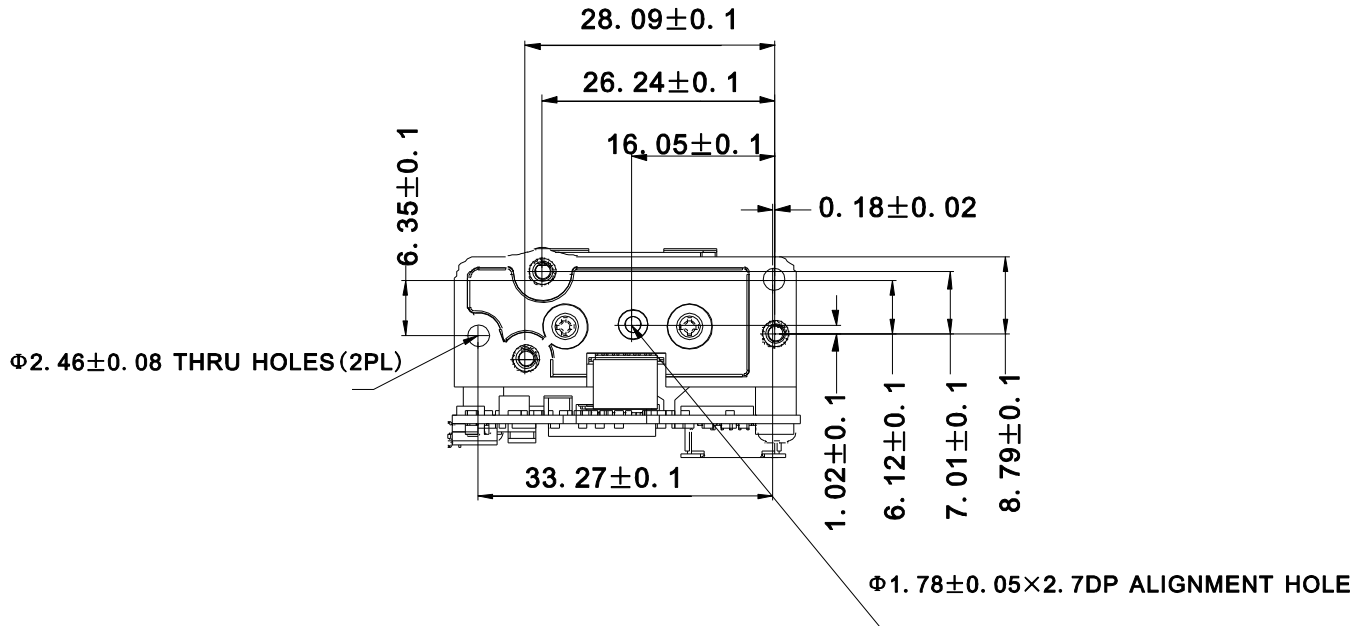


Figure 2-10

### Top View

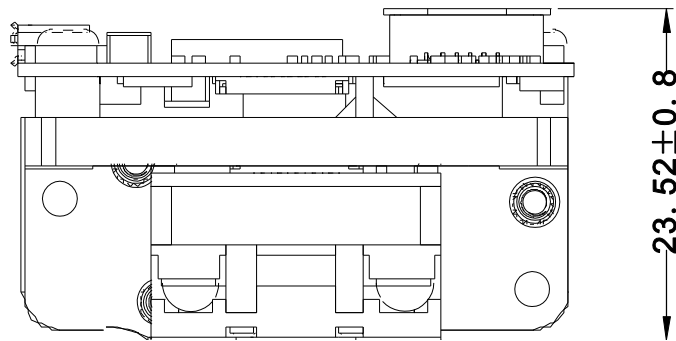


Figure 2-11

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

### Front View

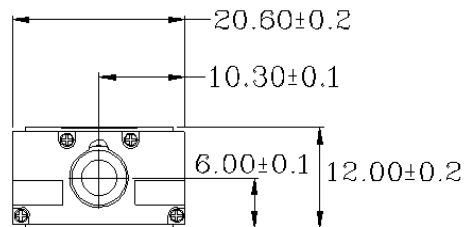


Figure 2-12

### Bottom View

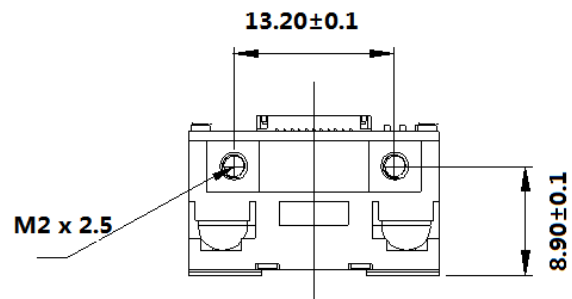


Figure 2-13

### Top View

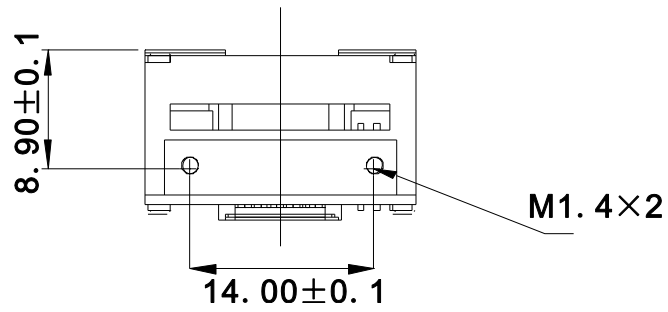


Figure 2-14

Right View

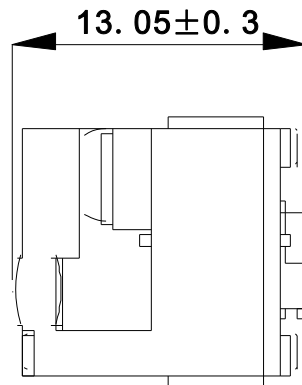


Figure 2-15

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

Front View

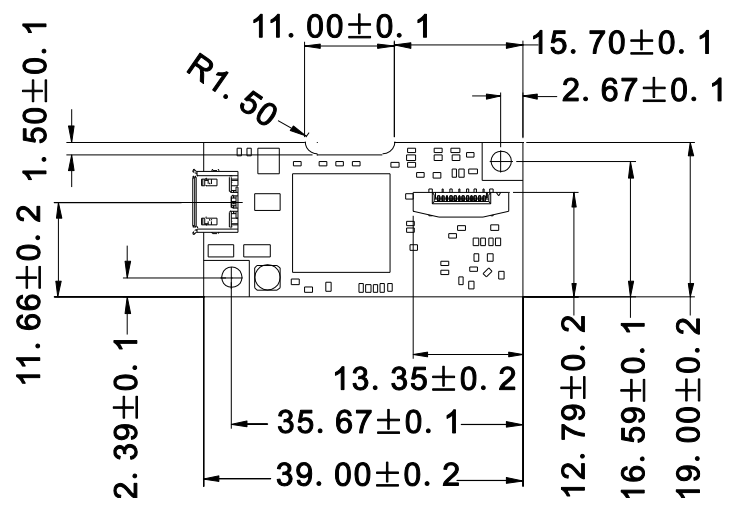


Figure 2-16

Back View

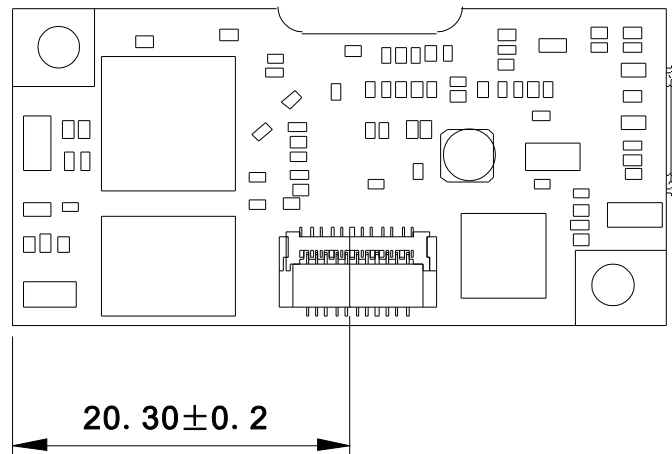


Figure 2-17

Right View

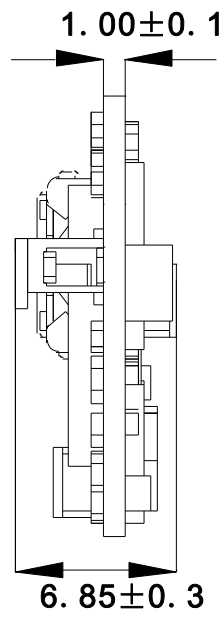


Figure 2-18

## Chapter 3 Electrical

### Power Supply

Do not input power until the engine is connected properly, otherwise the components inside the engine might be damaged. Be sure the power is cut off before connecting or disconnecting the flexible flat cable.

Unstable power supply or sharp voltage drop might make the engine under unstable state. Wait at least for 2s before supplying power again.

### Ripple Noise

The ripple noise of power supply should be within 50mV (peak-to-peak), and 50mV is the limit.

### DC Characteristics

#### Operating Voltage (T=23°C)

Parameter	Symbol	Minimum	Typical	Maximum	Unit
Operating Voltage	VIN (TTL232)	3.3	5.0	5.5	V
	VIN (USB)	4.5	5.0	5.5	V
Operating Current (@ 5.0V)	Operating Current	-	330	-	mA
	Idle Current	-	60	-	mA
	Low Power	-	1.2	-	mA

#### I/O Requirements

VDD=3.3V, VSS=0V, T=23°C

Parameter	Minimum	Maximum	Unit
VIL	VSS-0.1	VDD*0.2	V
VIH	VDD*0.8	VDD+0.1	V
VOL	VSS	VSS+0.3	V
VOH	VDD-0.3	VDD	V

## Chapter 4 Interfaces

### Interface Definition

The interface of EM2037 consists of 12 PIN-FPC and Micro USB:

- ✧ 12 PIN-FPC can either be TTL232 or USB form.

Note: One product model supports either TTL-232 or USB form.

- ✧ Micro USB can only be used as standard USB interface.

The location of 12 PIN-FPC connector and Micro USB connector are marked in below illustration.

For detailed signal definition of 12 PIN-FPC, please refer to the following sections about TTL232 and USB interfaces.

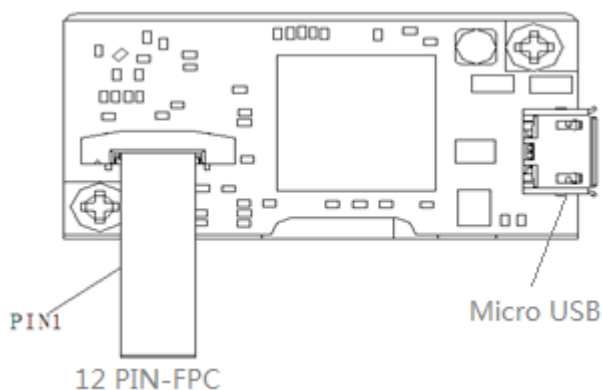


Figure 4-1

### TTL-232

When 12 PIN-FPC is set for TTL232 interface, the definitions for 12 PINs are as below:

PIN#	Signal	I/O	Description
1	Reserved	-	Reserved
2	VIN	-	Power-supply voltage input
3	GND	-	Power-supply and signal ground
4	RXD	I	Input-TTL level 232 receive data

5	TXD	O	Output-TTL level 232 transmit data
6	nCTS	I	Input-TTL level 232 clear to send signal
7	nRTS	O	Output-TTL level 232 request to send signal
8	PWRDWN	O	Output-Open Drain; 10K Pull up; active high indicator that EM2037 is in power down mode.
9	nBEEPER	O,od	Output – Open Drain; idle high signal that can be an active low DC or PWM controlled AC signal used to drive an external beeper.
10	nGoodRead	O,od	Output – Open Drain; active low signal for driving a low current Good Read LED circuit.
11	nWAKE	I,	Input, 100K Pull up – When in power down mode active low wake up signal to the EM2037.
12	nTRIG	I	Input, Weak Pull up – signal can be used a trigger input to the EM2037 to indicate trigger depressed and when programmed for host notify mode.

I = Input; O = Output; od = Open Drain;

## USB

When 12 PIN-FPC is set for USB interface, the definitions for 12 PINs are as below:

PIN#	Signal	I/O	Description
1	Reserved	-	Reserved
2	VIN	-	Power-Supply voltage input
3	GND	-	Power-Supply and signal ground
4	D-	I/O	USB D-signal
5	Reserved	O	Reserved
6	D+	I/O	USB D+signal
7	Reserved	O	Reserved
8	PWRDWN	O	Output-Open Drain; 10K Pull up; active high indicator that EM2037 is in power down mode.
9	nBEEPER	O,od	Output – Open Drain; idle high signal that can be an active

			low DC or PWM controlled AC signal used to drive an external beeper.
10	nGoodRead	O,od	Output – Open Drain; active low signal for driving a low current Good Read LED circuit.
11	nWAKE	I	Input, 100K Pull up – When in power down mode active low wake up signal to the EM2037.
12	nTRIG	I	Input, Weak Pull up – signal can be used a trigger input to the EM2037 to indicate trigger depressed and when programmed for host notify mode.

I = Input; O = Output; od = Open Drain;

## Micro USB

The signal definitions of USB interface on Micro USB connector conform to the standard definitions.

## Connector

There are 12 PIN-FPC connector and Micro USB connector on EM2037.

### 12 PIN-FPC

12 PIN-FPC connector is a CviLux Corporation FFC/FPC connector (Model No.:CF20121V0R0-LF).

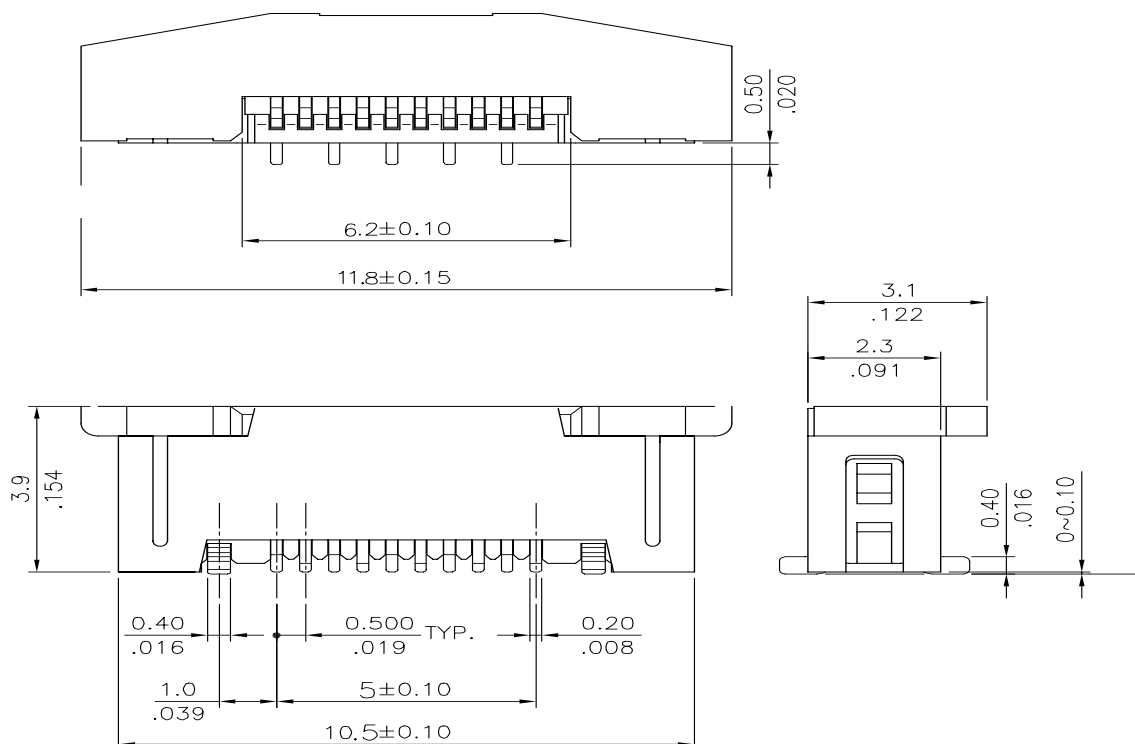


Figure 4-2

## Micro USB

Micro USB connector is a connector with standard definitions and can be used as standard methods.

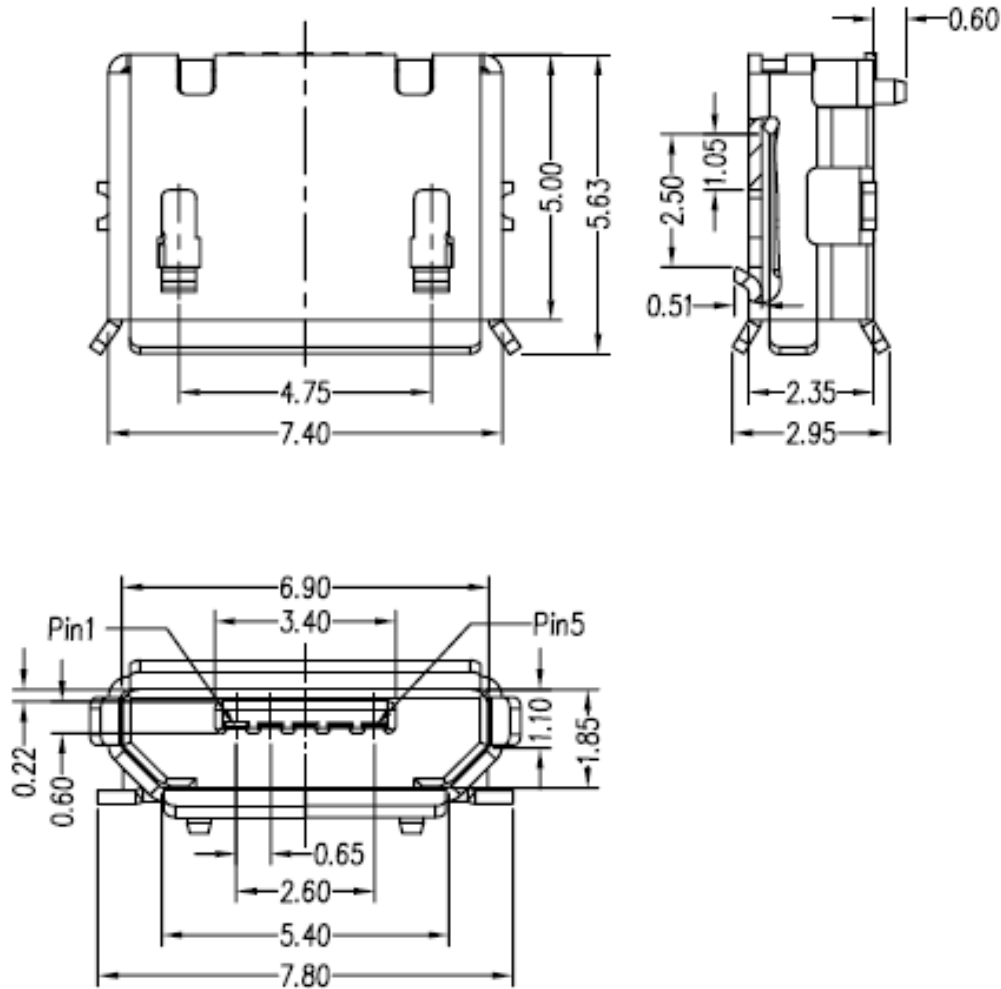


Figure 4-3

## External Circuit

### LED Circuit for Good Read

The illustration below shows the circuit of LED reminder for good read. The left part of Figure 4-5 is the driver circuit on EM2037 decoder board. The right part of Figure 4-5 is provided for design reference. nGoodRead signal comes from PIN10 of 12 PIN-FPC.

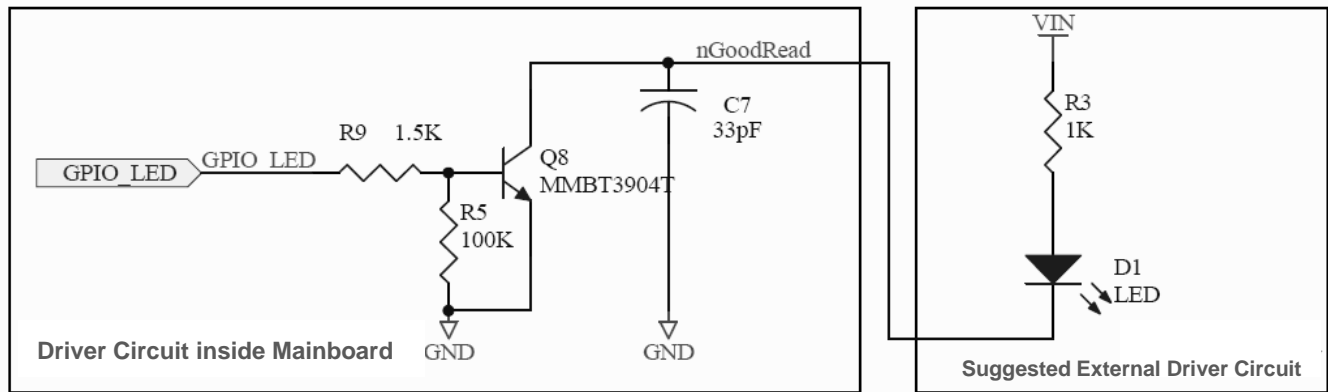


Figure 4-5

### Circuit for Beeper

The illustration below shows the circuit of Beeper. The left part of Figure 4-6 is the driver circuit on EM2037 decoder board. The right part of Figure 4-6 is provided for design reference. nBEEPER signal comes from PIN9 of 12 PIN-FPC.

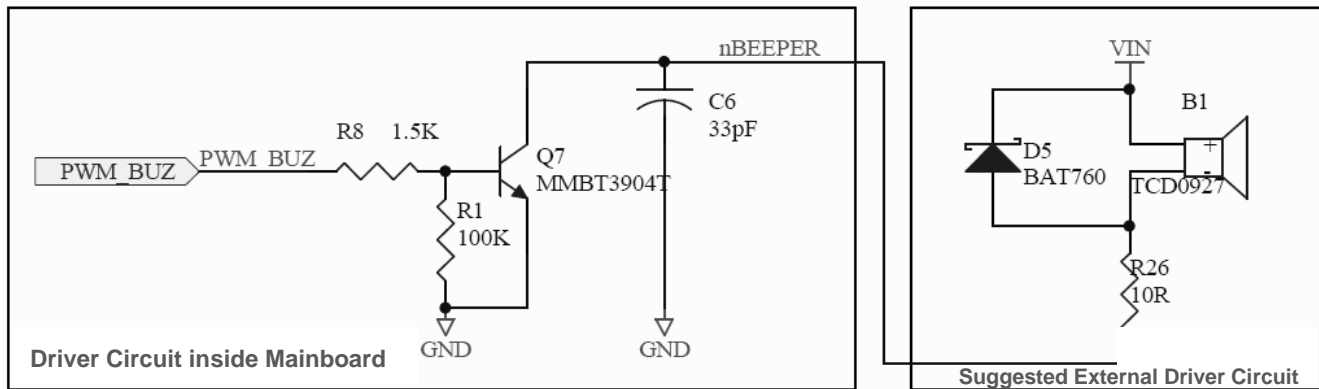


Figure 4-6

### Circuit for Sleep Mode LED

The illustration below shows the circuit of External LED for indicating sleep mode. The left part of Figure 4-7 is the driver circuit on EM2037 decoder board. The right part of Figure 4-7 is provided for design reference. PWRDWN signal comes from PIN8 of 12 PIN-FPC.

The host terminal can adjust the external circuit and its functions as per actual needs, but the external circuit should match the circuit of the decoder board.

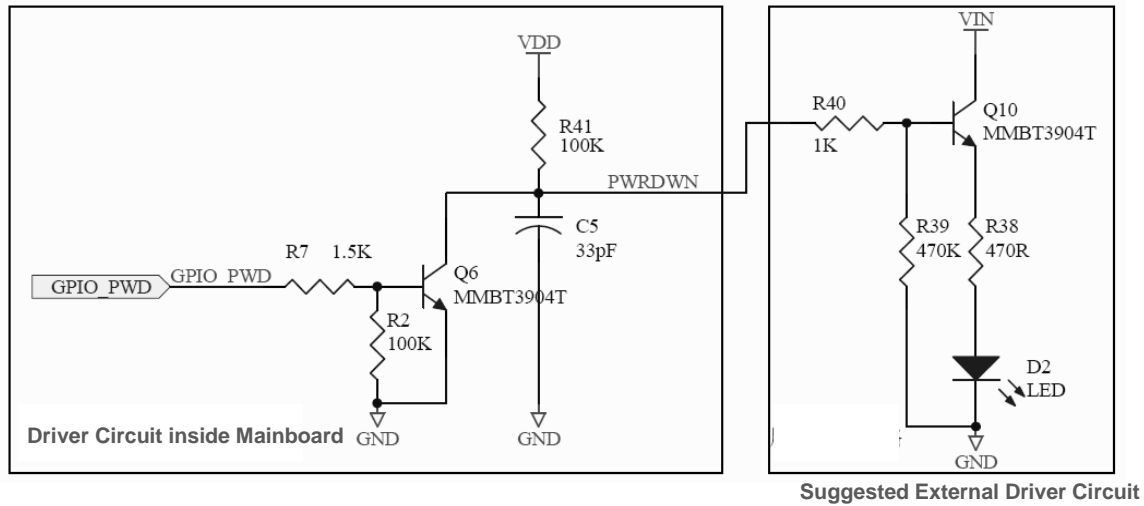


Figure 4-7

### Circuit for Activating the Engine

The illustration below shows the circuit of activating the EM2037 from sleep mode. The right part of Figure 4-8 is the receiving circuit on EM2037 decoder board. The left part of Figure 4-8 is provided for design reference. The nWAKE signal comes from PIN11 of 12 PIN-FPC.

The host terminal can adjust the external circuit and its functions as per actual needs, but the external circuit should match the circuit of the decoder board.

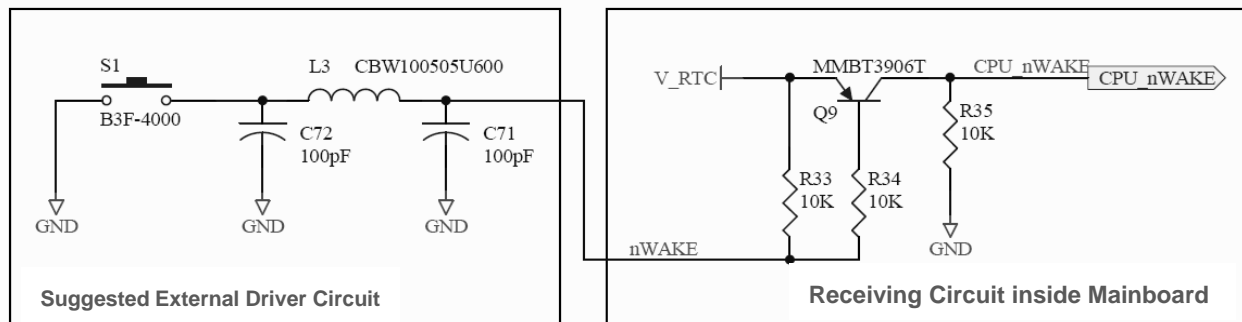


Figure 4-8

### Circuit for Trigger

The illustration below shows the circuit which provides EM2037 with the trigger signal and thus enables a read. The right part of Figure 4-9 is the receiving circuit on EM2037 decoder board. The left part of Figure 4-9 is provided for design reference. The nTRIG signal comes from PIN12 of 12 PIN-FPC.

The host terminal can adjust the external circuit and its functions as per actual needs, but the external circuit should match the circuit of the decoder board.

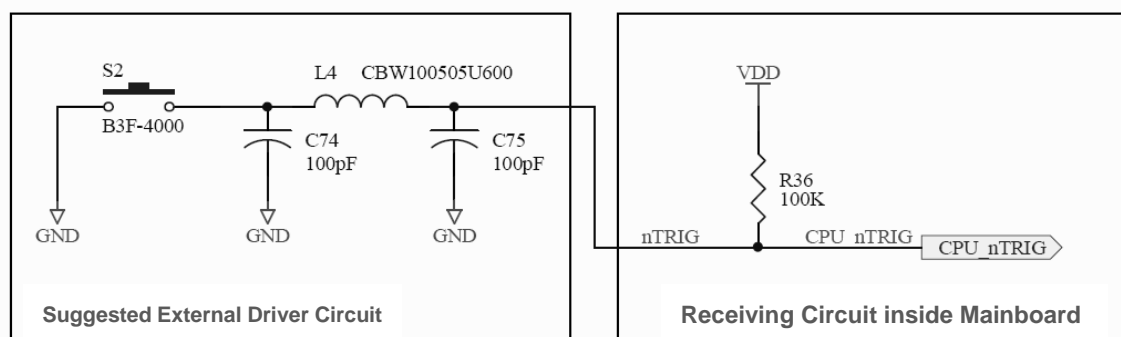


Figure 4-9

## Chapter 5 Development Tools

EM2037 has both hardware and software developer kits for second development, which provides convenience and ease for quick development and function settings.

### **EVK**

Newland provides EVK for test and evaluation on EM2037. This EVK includes beeper and beeper's driver circuit, LED and LED's driver circuit, trigger, reset key, RS232 interface, USB interface and so forth. The engine can be mounted on EVK via 12-PIN flexible flat cable. This EVK provides both USB and RS232 interfaces.

### **QuickSet / uExpress**

Newland provides software developer kits like QuickSet and uExpress for software development and function settings on EM2037 under Windows System.



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