



**NLS-EM2039 Series
OEM Scan Engine
Integration Guide**



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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, doing so will void the product warranty provided by Fujian Newland Auto-ID Tech. Co., Ltd.

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Revision History

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Chapter 1 Introduction

Product Overview

NLS-EM2039 series OEM scan engines, armed with the Newland patented **UIMG**[®], a computerized image recognition system, bring about a new era of 2D barcode scan engines.

The EM2039s' decoder chip ingeniously blends **UIMG**[®] technology and advanced chip design & manufacturing, which significantly simplifies application design and delivers superior performance and solid reliability with low power consumption.

The EM2039s support all mainstream 1D and standard 2D barcode symbologies (e.g., PDF417, QR Code M1/M2/Micro and Data Matrix) as well as GS1-DataBarTM(RSS) (Limited/Stacked/Expanded versions).

Documentation Set

Documents related to the EM2039 include:

<i>NLS-EM2039 series Embedded 2D Barcode Scan Engine Integration Guide:</i>	Describes how to integrate the EM2039.
<i>NLS-EM2039 series Embedded 2D Barcode Scan Engine User Guide:</i>	Explains how to use and program the EM2039.
<i>NLS-EM2039 series Embedded 2D Barcode Scan Engine Datasheet:</i>	Gives a general description of the EM2039 along with its technical specifications.

Aimer

The EM2039 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 EM2039 has two red LEDs (wavelength: 625 ± 10 nm) for supplementary lighting, making it possible to scan barcodes even in complete darkness. The illumination can be programmed On or Off.

Since red light is used as illumination and the engine's lens imaging system is coated with AR film which has obvious anti-reflection effect against red light, the engine shows better reading performance on barcodes printed in non-red colors. For applications involving red barcodes, it is advised to use non-red supplementary lighting. 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 EM2039 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 EM2039 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.

Ambient Environment

The following environmental requirements should be met to ensure good performance of the EM2039:

Operating Temperature	-20°C to 60°C
Storage Temperature	-40°C to 80°C
Humidity	5% to 95% (non-condensing)

Thermal Considerations

Electronic components in the EM2039 generate heat during the course of their operation. Operating the EM2039 in continuous mode for an extended period may result in an increase in temperature inside the engine. The following precautions should be taken when integrating the EM2039:

- ✧ Reserve sufficient space for good air circulation during design.
- ✧ Avoid wrapping the EM2039 with thermal insulation materials such as rubber.

Installation Orientation

Fig. 2-1 illustrates a front view of the EM2039 after installation.

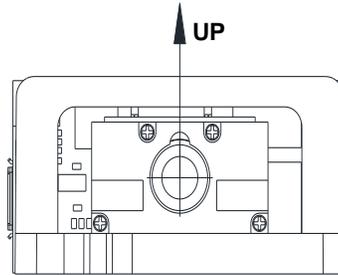


Fig. 2-1

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 farthest surface of the window. Avoid unwanted reflections and use thin material for window so as to reach better reading performance. As shown in Fig. 2-2, 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.

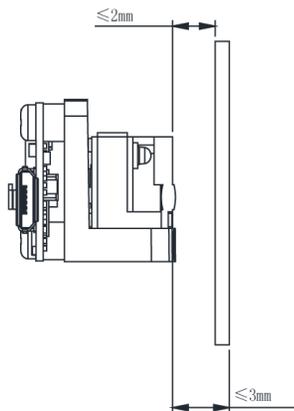


Fig. 2-2

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 EM2039. 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.

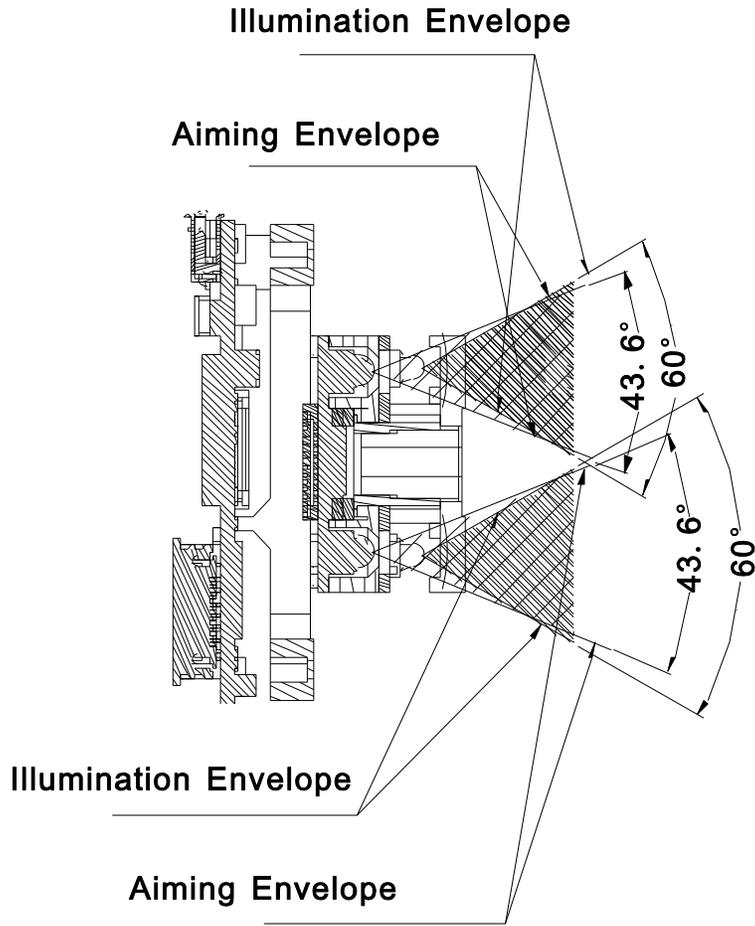


Fig. 2-3

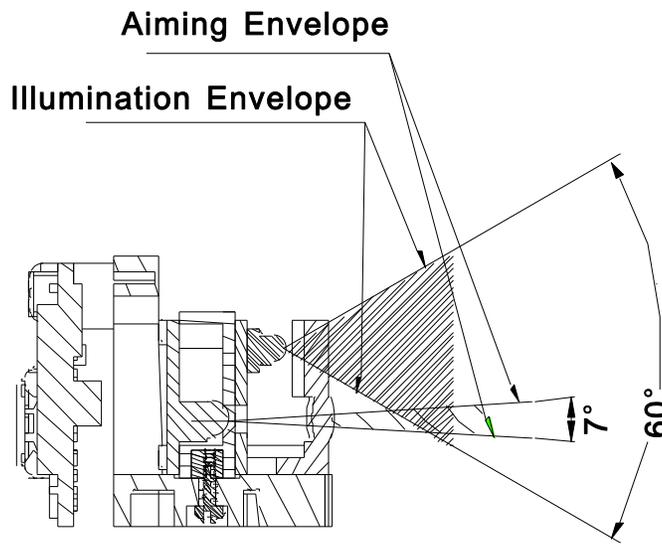


Fig. 2-4

FOV

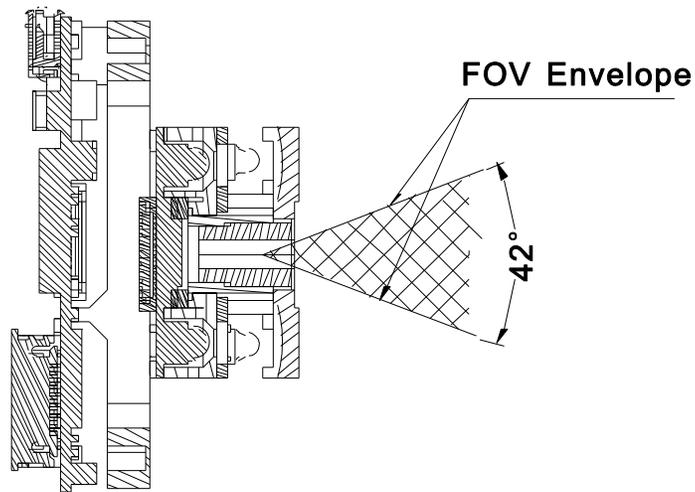


Fig. 2-5

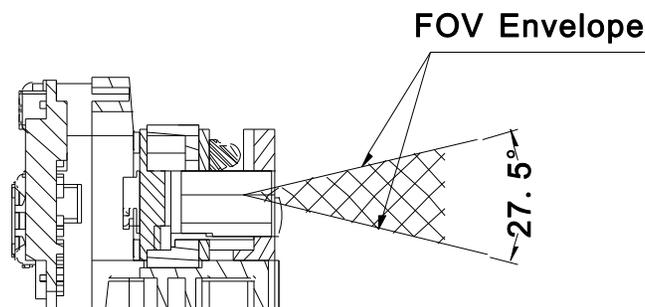


Fig. 2-6

Ambient Light

The EM2039 shows better performance with ambient light. However, high-frequency pulsed light can result in performance degradation.

Eye Safety

The EM2039 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 EM2039s provide two-in-one type (imager and decoder board assembled on an L-shaped bracket) and split type (imager and decoder board separated) to cater for different mounting needs. For the two-in-one type, the user can simply mount the EM2039 on the target device. The two-in-one type is easy for integration and is suitable for devices with enough space inside. For the split type, the decoder board and the imager should be separately mounted and connected with an FFC cable. The split type is more flexible for integration and suits devices with smaller space inside.

The illustrations below show the mechanical mounting dimensions for the EM2039s. 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 EM2039.

Two-in-one Type (unit: mm)

Front View

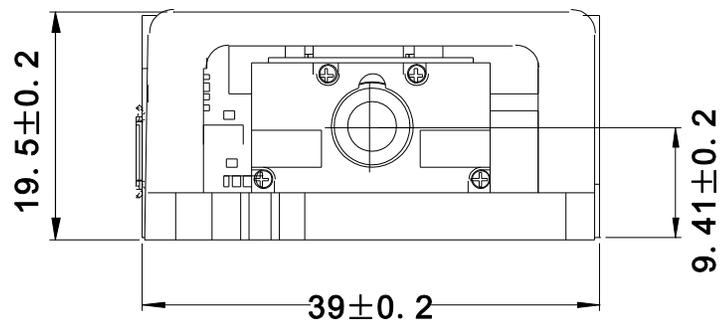


Fig. 2-7

Bottom View

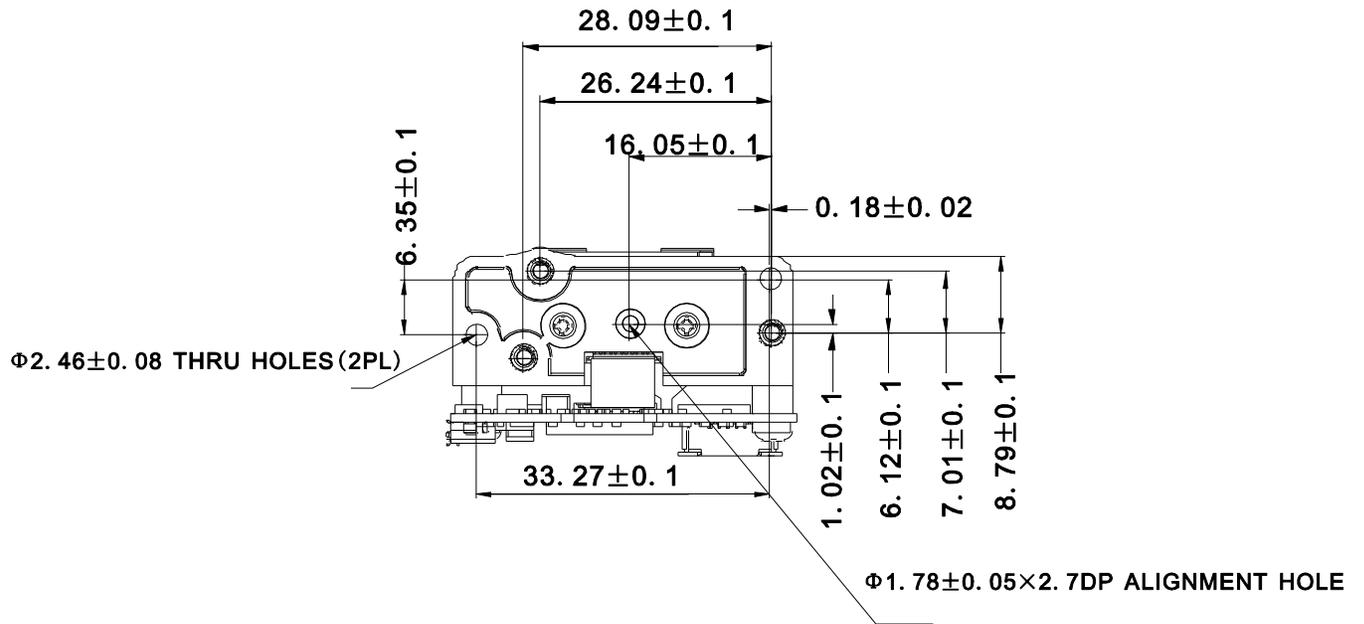


Fig. 2-8

Top View

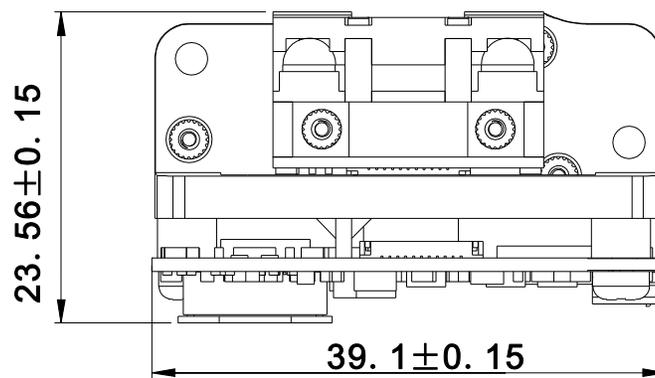


Fig. 2-9

Imager - Split Type (unit: mm)

Front View

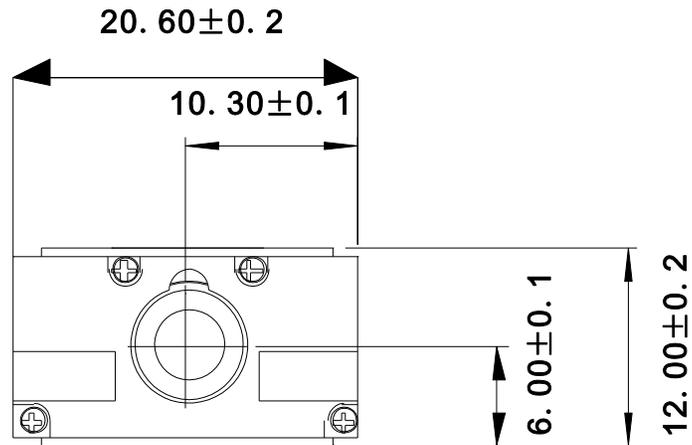


Fig. 2-10

Bottom View

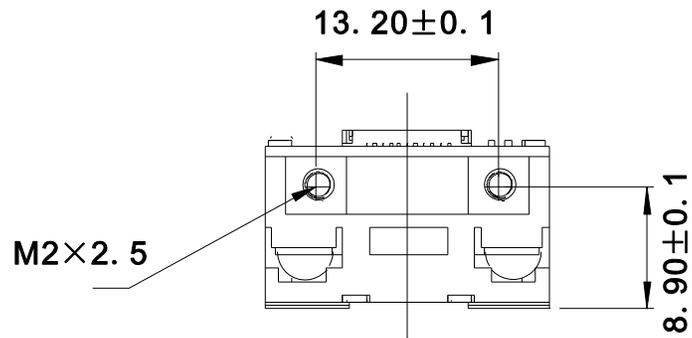


Fig. 2-11

Top View

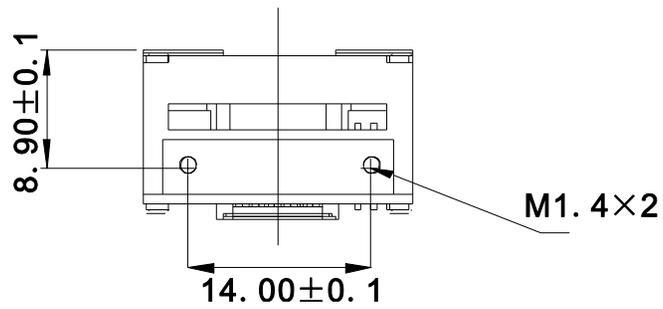


Fig. 2-12

Right View

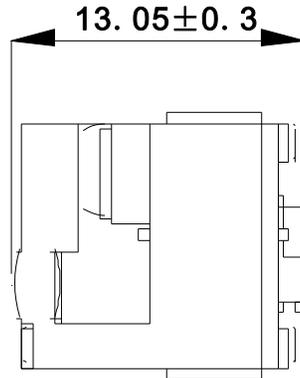


Fig. 2-13

Decoder Board - Split Type (unit: mm)

Front View

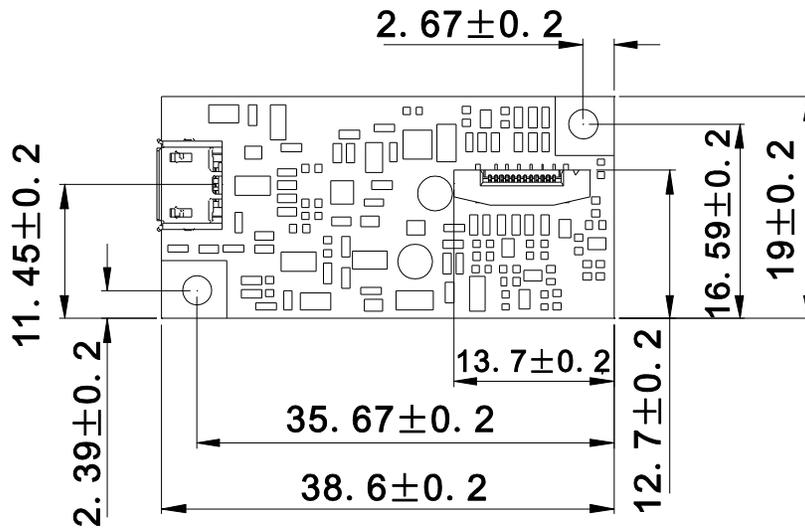


Fig. 2-14

Back View

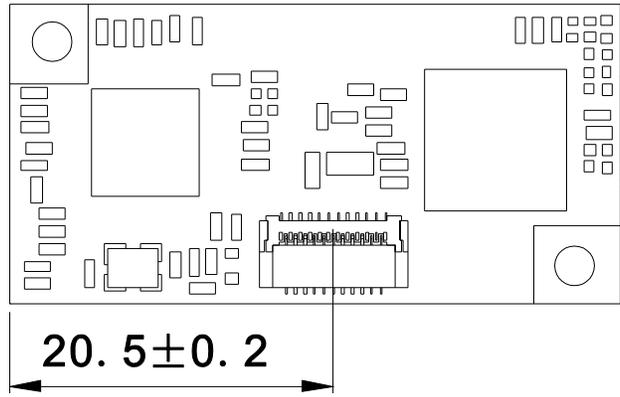


Fig. 2-15

Right View

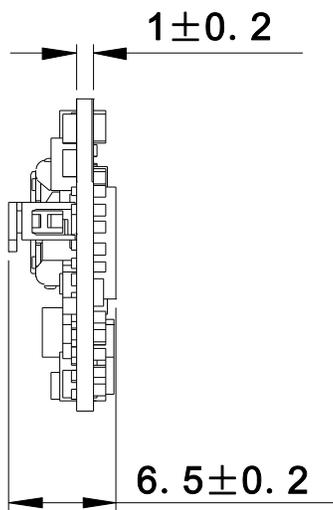


Fig. 2-16

Chapter 3 Electrical Specifications

Power Supply

Do not power up the EM2039 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. This 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 500ms.

Ripple Noise

The ripple noise of power supply should be within 50mV (peak-to-peak).

DC Characteristics

Operating Voltage

T=23°C

Parameter		Minimum	Typical	Maximum	Unit
Operating Voltage	V _{IN}	3.0	3.3	5.5	V
Current (@3.3V)	I _{OP}	-	425	-	mA
	I _{Idle}	-	11	-	mA
	I _{Low power}	-	3.5	-	mA

I/O Requirements

VDD=3.3V, VSS=0V, T=23°C

Parameter	Minimum	Maximum	Unit
V _{IL}	-0.3	0.2*VDD	V
V _{IH}	0.7*VDD	VDD+0.3	V
V _{OL}	-	0.4	V
V _{OH}	VDD-0.4	-	V

Chapter 4 Interfaces

Connections & Pinouts

The EM2039 is equipped with 12-pin FPC connector and Micro USB connector.

- ✧ 12-pin FPC connector can be used as TTL-232 interface or USB interface.
- ✧ Micro USB connector can only be used as standard USB interface.

Fig. 4-1 illustrates the positions of 12-pin FPC connector and Micro USB connector on the EM2039's decoder board, as well as the pin layout of FPC connector.

See the following **TTL-232** and **USB** sections to learn about the pinouts of FPC connector.

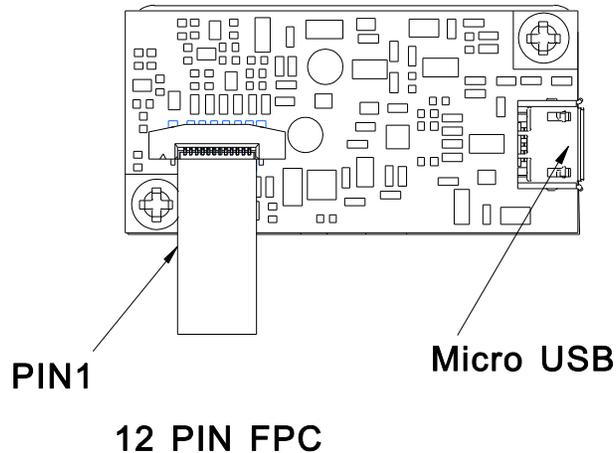


Fig. 4-1

TTL-232

The table below describes the pin functions of FPC connector used as TTL-232 interface.

PIN#	Signal Name	I/O	Function
1	232INV	O	Output: High = TTL-232 interface; Low = USB interface
2	VIN	-	Power: supply voltage input
3	GND	-	Ground: power and signal ground
4	RXD	I	Input: TTL level RS-232 receive data
5	TXD	O	Output: TTL level RS-232 transmit data
6	nCTS	I	Input: TTL level RS-232 clear to send
7	nRTS	O	Output: TTL level RS-232 request to send
8	PWRDWN	O	Output: Active high = scan engine is in sleep mode
9	nBEEPER	O,od	Output-Open Drain: Beeper output
10	nGoodRead	O,od	Output-Open Drain: Good read LED output
11	nWAKE	I	Input: Active low, wakes the engine from sleep mode
12	nTrig	I	Input: Active low, signal used as trigger input to activate the engine to start a scan and decode session

USB

The table below describes the pin functions of FPC connector used as USB interface.

PIN#	Signal Name	I/O	Function
1	232INV	O	Output: High = TTL-232 interface; Low = USB interface
2	VIN	-	Power: supply voltage input
3	GND	-	Ground: power and signal ground
4	D-	I/O	Input/Output: USB D- signal
5	Reserved	-	Pin function reserved
6	D+	I/O	Input/Output: USB D+ signal
7	Reserved	-	Pin function reserved
8	PWRDWN	O	Output: Active high = scan engine is in sleep mode
9	nBEEPER	O,od	Output-Open Drain: Beeper output
10	nGoodRead	O,od	Output-Open Drain: Good read LED output
11	nWAKE	I	Input: Active low, wakes the engine from sleep mode
12	nTrig	I	Input: Active low, signal used as trigger input to activate the engine to start a scan and decode session

Micro USB

The Micro USB connector on the EM2039 is a standard connector and can be used accordingly.

Host Interface Connectors

The EM2039 is equipped with 12-pin FPC connector and Micro USB connector.

12-Pin FPC Connector

The EM2039 uses an FFC/FPC connector (CF20121V0R0-LF) manufactured by CviLux.

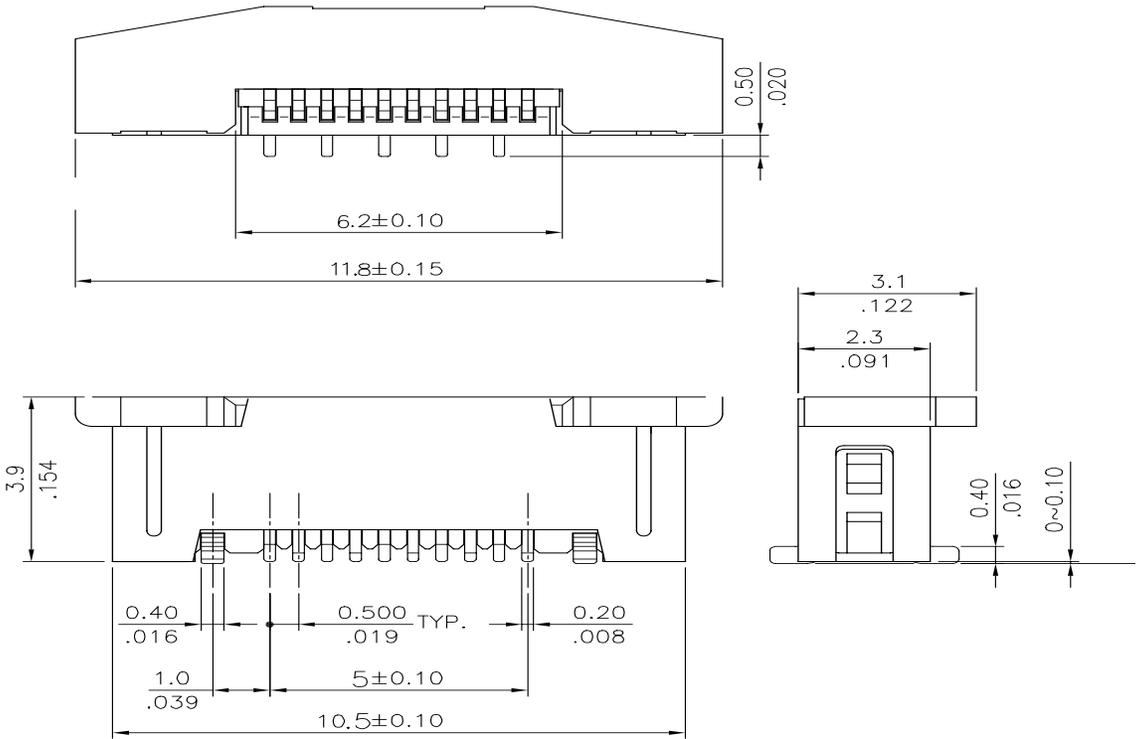


Fig. 4-2

Micro USB Connector

The EM2039's Micro USB connector is a standard connector and can be used accordingly.

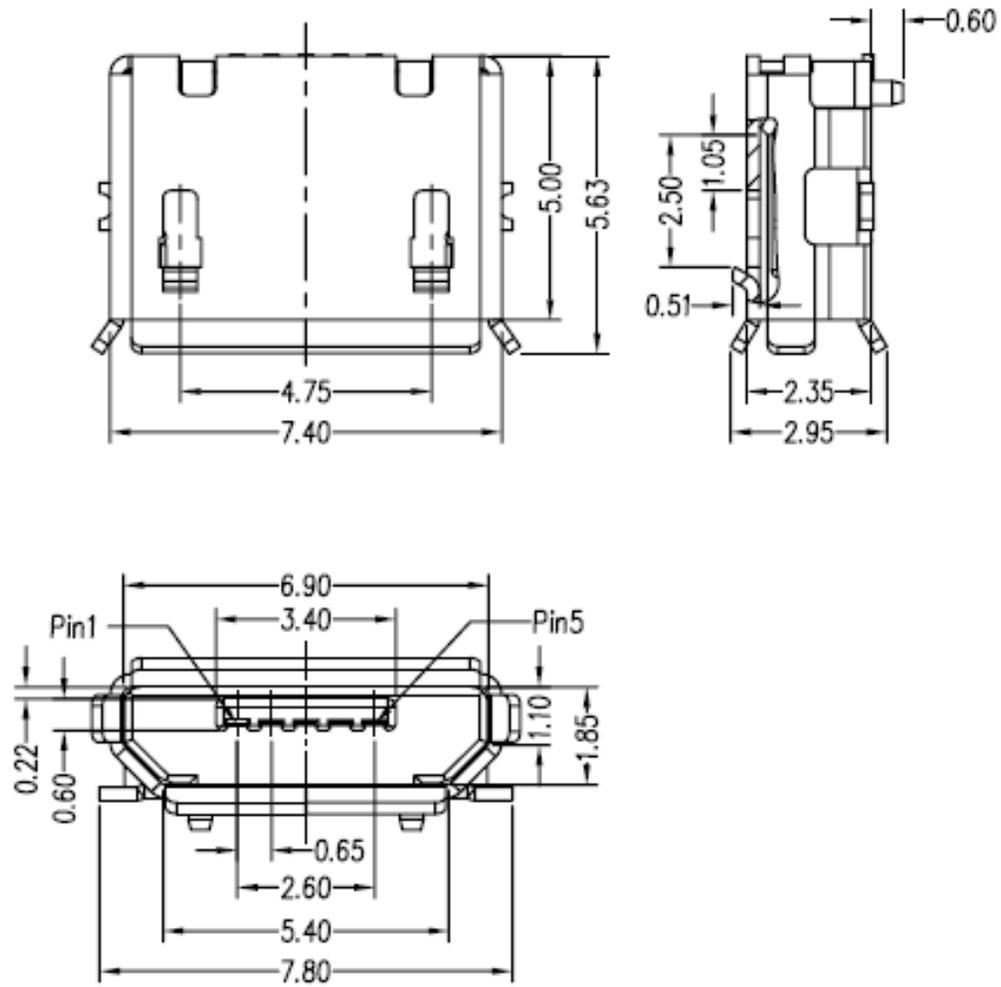


Fig. 4-3

External Circuits

Good Read LED Circuit

The circuit below is used to drive an external LED for indicating good read. The left part shows internal Good Read LED driver circuit on the decoder board and the right part shows external circuit that users may utilize in actual application. The nGoodRead signal is from Pin 10 of the 12-pin FPC connector.

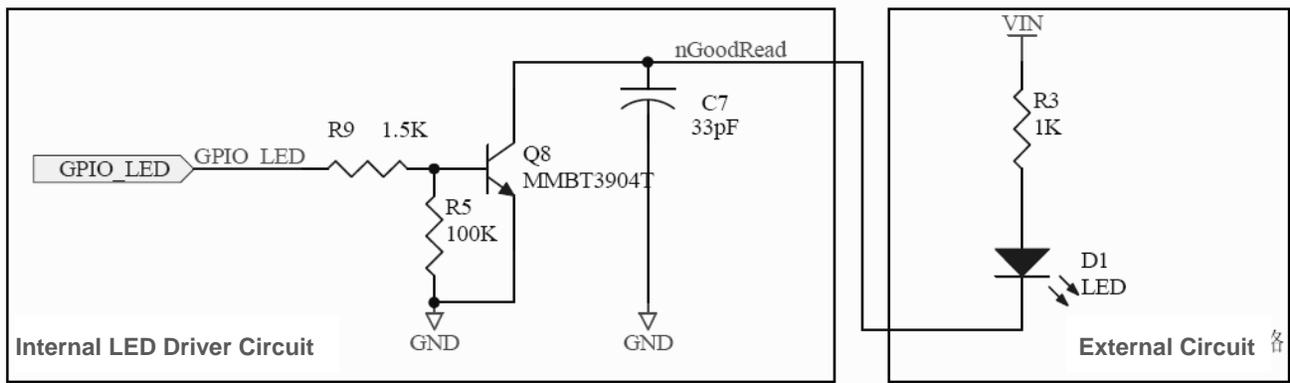


Fig. 4-4

Beeper Circuit

The circuit below is used to drive an external beeper. The left part shows internal beeper driver circuit on the decoder board and the right part shows external circuit that users may utilize in actual application. The nBEEPER signal is from Pin 9 of the 12-pin FPC connector.

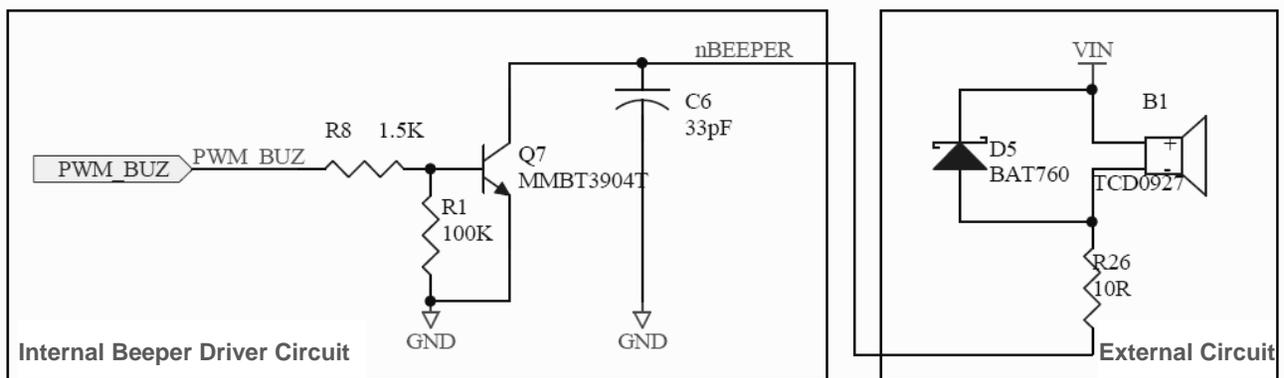


Fig. 4-5

Sleep Mode LED Circuit

The circuit below is used to drive an external LED for indicating that the engine is in sleep mode. The left part shows internal Sleep Mode LED driver circuit on the decoder board and the right part shows external circuit that users may utilize in actual application. The PWRDWN signal is from Pin 8 of the 12-pin FPC connector.

Users can adjust the external circuit and its function as per actual needs, on condition that the external circuit matches the internal circuit.

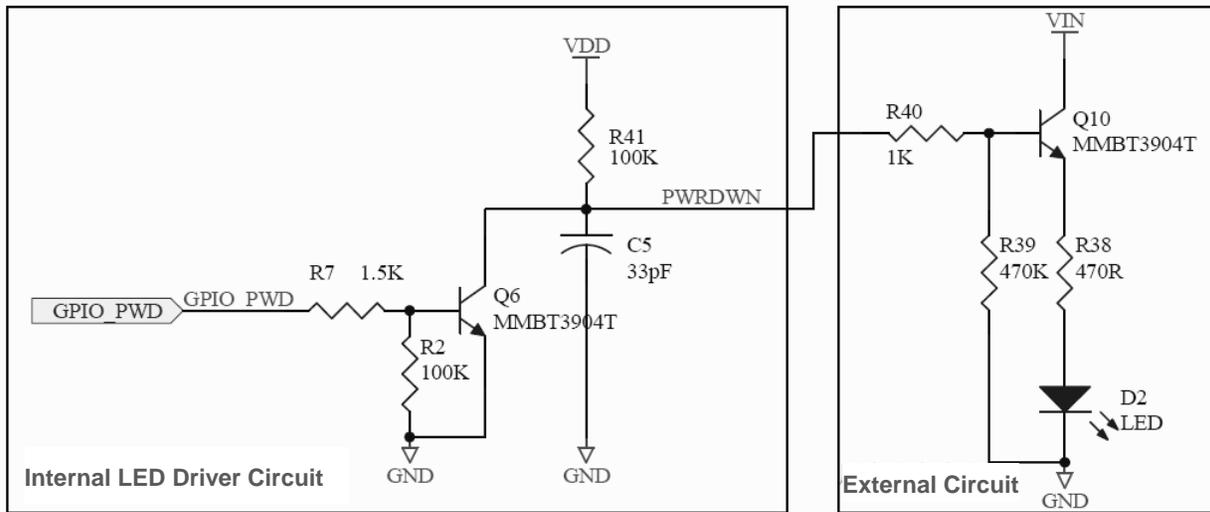


Fig. 4-6

Wake-up Circuit

The circuit below is used to wake the engine from sleep mode. The right part shows internal driver circuit on the decoder board and the left part shows external circuit that users may utilize in actual application. The nWAKE signal is from Pin 11 of the 12-pin FPC connector.

Users can adjust the external circuit and its function as per actual needs, on condition that the external circuit matches the internal circuit.

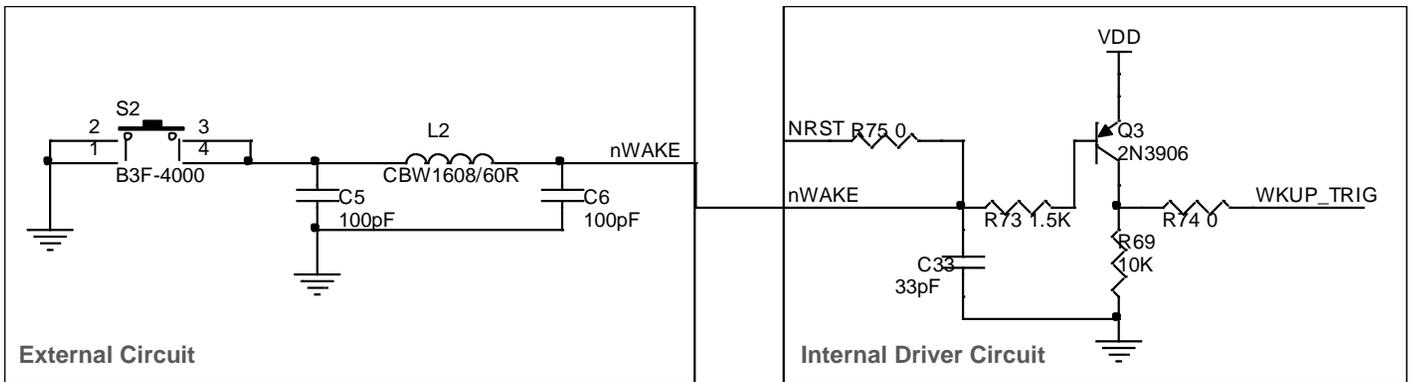


Fig. 4-7

Trigger Circuit

The circuit below is used to provide the engine with an active low signal to activate a scan and decode session. The right part shows internal driver circuit on the decoder board and the left part shows external circuit that users may utilize in actual application. The nTrig signal is from Pin 12 of the 12-pin FPC connector.

Users can adjust the external circuit and its function as per actual needs, on condition that the external circuit matches the internal circuit.

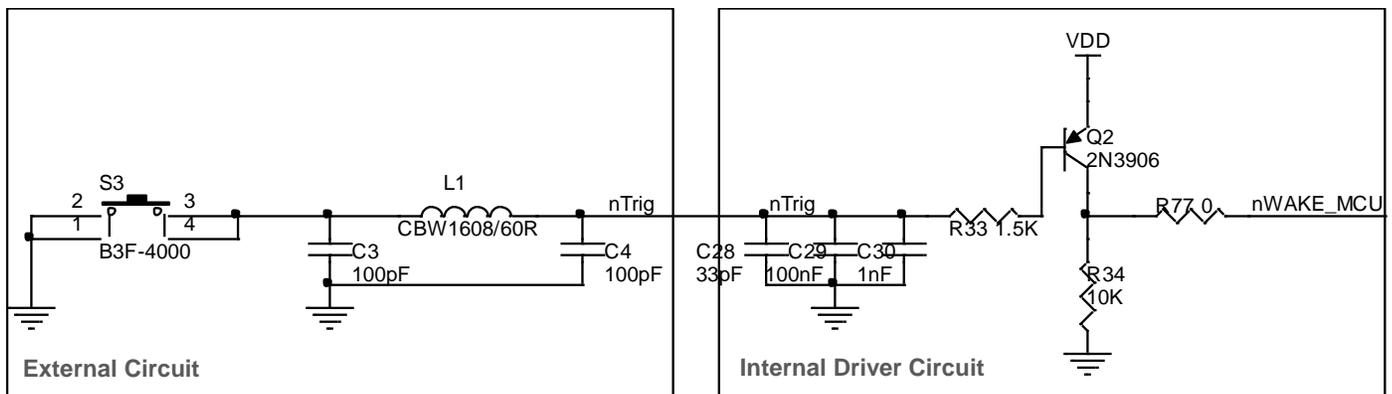


Fig. 4-8

Chapter 5 Development Tools

The EM2039'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 EM2039, 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 EM2039 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 application development and function settings for the EM2039 under Windows.



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