



Newland

SCANNING MADE SIMPLE



EM20-85
OEM scan engine
integration guide

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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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Fujian Newland Auto-ID Tech. Co., Ltd.

3F, Building A, No.1, Rujiang West Rd., Mawei, Fuzhou, Fujian, China 350015

<http://www.newlandaidc.com>

Revision History

Version	Description	Date
V1.0.0	Initial release.	April 6, 2021
V1.0.1	Updated the 8-pin Box Connector section in Chapter 3.	May 12, 2021

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About This Guide

Introduction


The NLS-EM20-85 OEM scan engines (hereinafter referred to as “the EM20-85” or “the engine”) are armed with CMOS image capturer and the Newland patented **UIMG**[®], a computerized image recognition system-on-chip, featuring fast scanning and accurate decoding on barcodes on virtually any medium-paper. The EM20-85 can be easily integrated into OEM equipment or systems, such as handheld, portable, or stationary barcode scanners. The EM20-85 offers fully open image acquisition interface, raw data interface and I/O interface, which enables users to easily develop their own applications with Newland’s SDK.

※ Note: This guide provides general instructions for the installation of the engine into a customer's device. Fujian Newland Auto-ID Tech. Co., Ltd. recommends an opto-mechanical engineer should conduct an opto-mechanical analysis before integration.

Chapter Description

Chapter 1, Getting Started	Gives a general description of the EM20-85.
Chapter 2, Installation	Describes how to install the engine, including installation information, housing design, optical, grounding, ESD, and environmental considerations.
Chapter 3, Interfaces	Includes interface pinout and connector specifications.
Chapter 4, Electrical Specifications	Includes the electrical characteristics for the engine and timing sequences.
Chapter 5, External Reference Circuit	Provides external driver circuit diagrams.
Chapter 6, Auxiliary Tool	Introduces the useful tool you can use to configure the EM20-85.

Explanation of Symbols

- This symbol indicates lists of required steps.
- ※ This symbol indicates something important to the readers. Failure to read the notice will not lead to harm to the reader, device or data.
-  This symbol indicates caution that, if ignored, may cause data or device damage or even personal injury.

Related Documents

- 8-pin box connector specification, Xiamen PinToPin Electronic Technology Co.,Ltd., Model: 1.0T-8AWB, <http://www.ptpxm.com/>
- 12-pin FPC connector specification, Shenzhen Mos Electronic Technology Co.,Ltd., Model: 0.5-18-12PBX-AL-P, <http://www.msdsz.com/>

Chapter 1 Getting Started

Introduction

The EM20-85 is an area image engine for barcode reading. It includes four illumination LEDs and a 12-pin FPC connector and a 8-pin box connector.

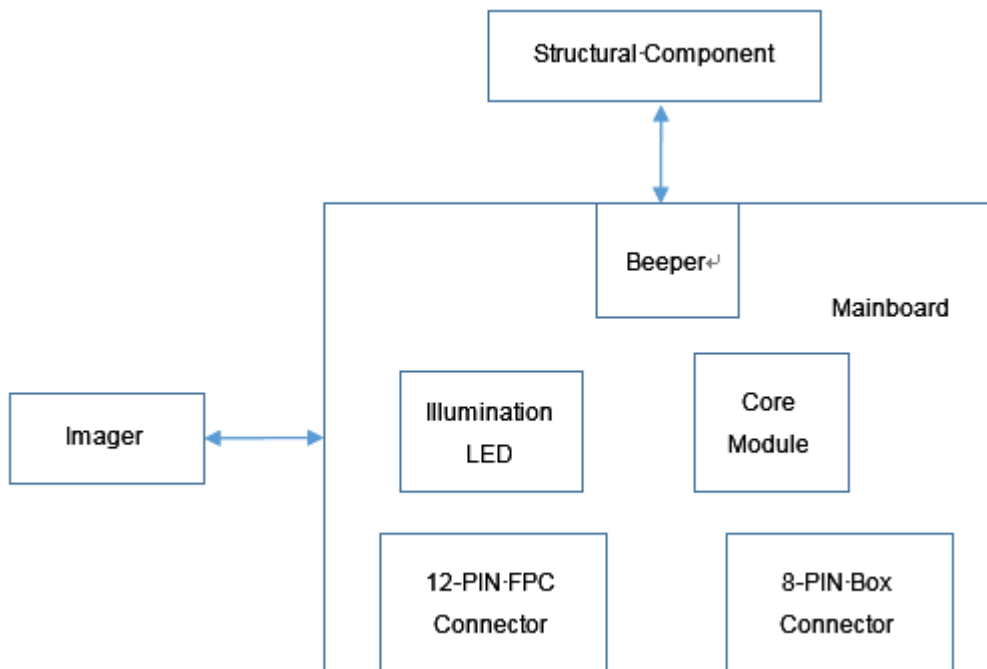
LED Compliance Statement

The EM20-85 complies with IEC 62471:2006 for LED safety.

The EM20-85 contains:

- a CMOS image sensor and its lens
- four LEDs
- a 12-pin FPC connector
- a 8-pin box connector

Figure 1-1 System Block Diagram



The 12-pin FPC connector/8-pin box connector on the engine can be connected to a host device with an appropriate cable. For more information about this connector, please see Chapter 3.

Illumination

The EM20-85 has four white LEDs for supplementary lighting, making it possible to scan barcodes even in complete darkness. The illumination can be programmed On or Off.

Buzzer

The EM20-85 provides a buzzer to indicate power-on and good read statuses. The Power On Beep and Good Read Beep can be programmed On or Off, and the Good Read Beep Volume, Duration and Frequency are also programmable by the user. To learn how to program these parameters, please see the EM20-85 user guide.

Chapter 2 Installation

Introduction

This chapter explains how to install the EM20-85, 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.

General Requirements

ESD

ESD protection has been taken into account when designing the EM20-85. 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 EM20-85 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 EM20-85.

Table 2-1

Operating Temperature	-20°C ~ 60°C
Storage Temperature	-40°C ~ 75°C
Humidity	5% ~95% (non-condensing)

Thermal Considerations

Electronic components in the EM20-85 will generate heat during the course of their operation. Operating the EM20-85 in continuous mode for an extended period may cause temperatures to rise on CPU, CIS, LEDs, etc. Overheating can degrade image quality and affect scanning performance. Given that, the following precautions should be taken into consideration when integrating the EM20-85.

- ✧ Avoid continuous use of LEDs for prolonged periods.
- ✧ Reserve sufficient space for good air circulation in the design.
- ✧ Avoid wrapping the EM20-85 with thermal insulation materials such as rubber.

Optical Elements

Windows should be designed to prevent the surface of lens from being exposed to contaminants such as dust, liquids, or grease, which may lead to damage to lens and degrade scanning efficiency.

During installation, keep the surface of lens away from any objects to prevent scratching and contamination of lens. The operator should avoid talking directly towards lens.

Mounting

The illustrations below show the mechanical mounting dimensions (unit: mm) for the EM20-85.

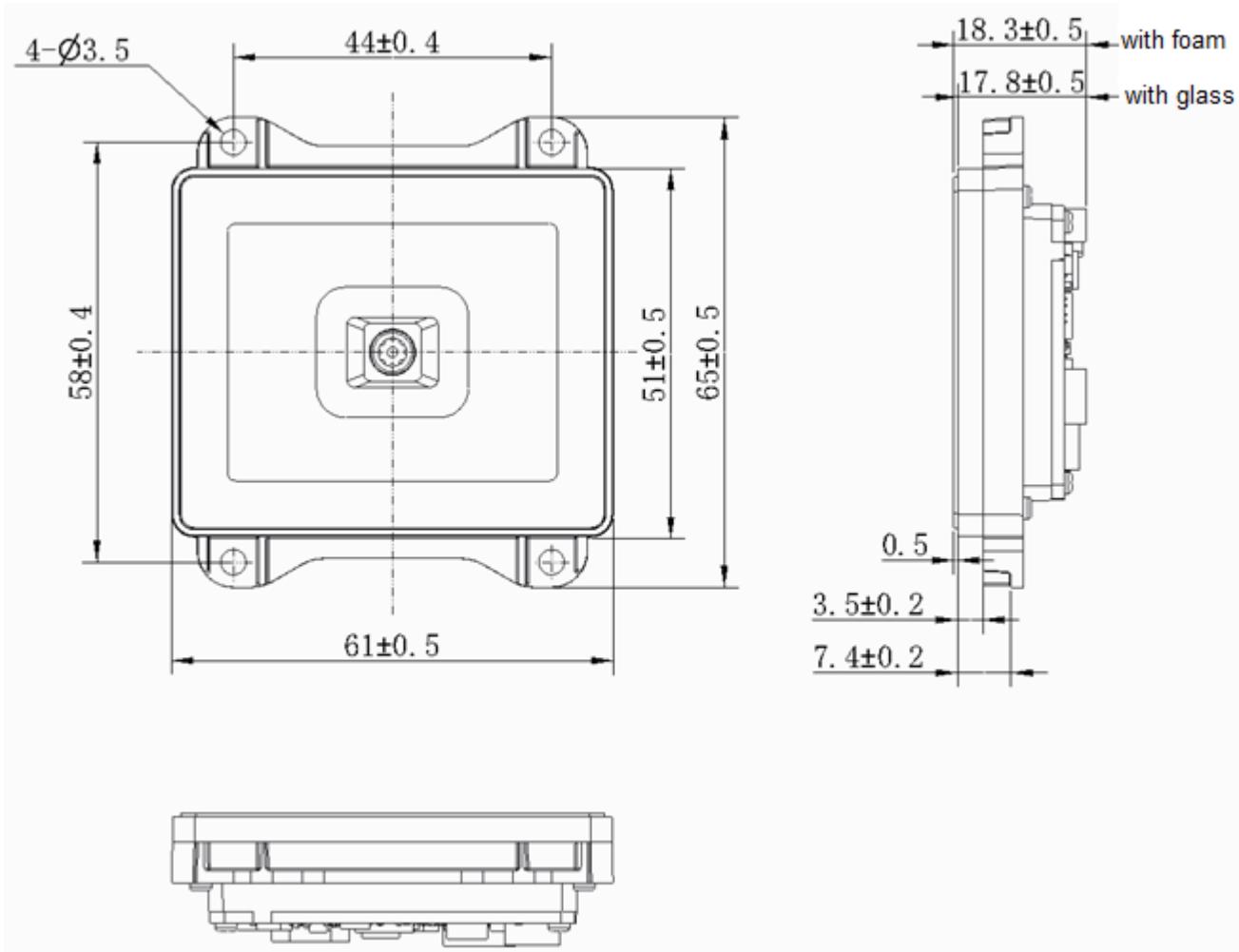


Figure 2-1

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 EM20-85 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).

The window should be mounted directly against the front of the engine ($a=0$).

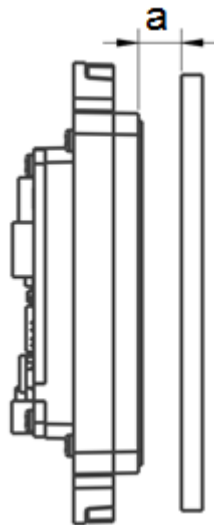


Figure 2-2

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 2-2**. 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 chemicals, 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 can not be ultrasonically welded.

Table 2-2

Specification	Description
Thickness	0.8-2.0mm
Wavefront Distortion	PV maximum: 0.2λ RMS maximum: 0.04λ
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 EM20-85. 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: 92% minimum transmittance within spectrum range from 420 nm to 730 nm.

Double side AR coating: 97% minimum transmittance within spectrum range from 420 nm to 730 nm.

Window Size

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

Horizontal:

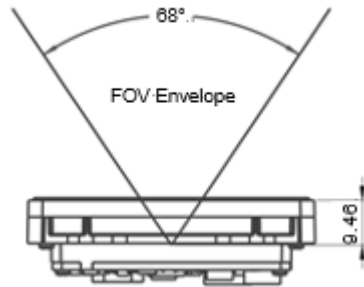


Figure 2-3

Vertical:

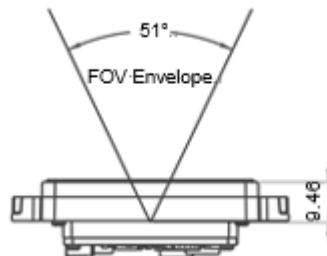


Figure 2-4

Roll, Skew and Pitch

Three different reading angles, roll, skew and pitch are illustrated in **Figure 2-6**. 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 Newland website or contact your dealer.

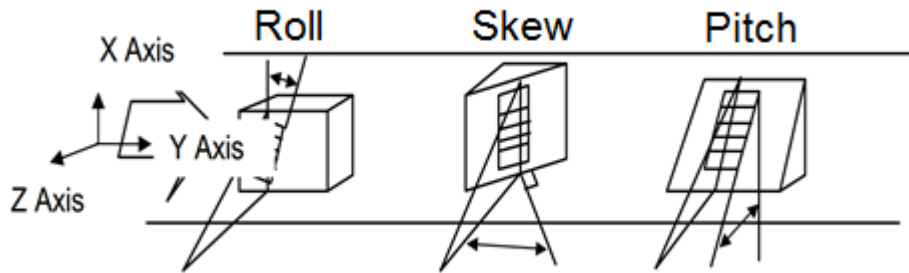


Figure 2-5

Ambient Light

The EM20-85 shows better performance with ambient light. However, high-frequency pulsed light can result in performance degradation.

Eye Safety

The EM20-85 has no lasers. It uses LEDs to produce illumination beam. 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.

Chapter 3 Interfaces

Interface Pinouts

The physical interface of the EM20-85 consists of a 8-pin box connector and a 12-pin FPC connector:

- 8-pin box connector can be used as RS-232 interface or USB interface.
- 12-pin FPC connector can be used as TTL-232 interface or USB interface.

The figure below illustrates the position of connectors on the EM20-85.

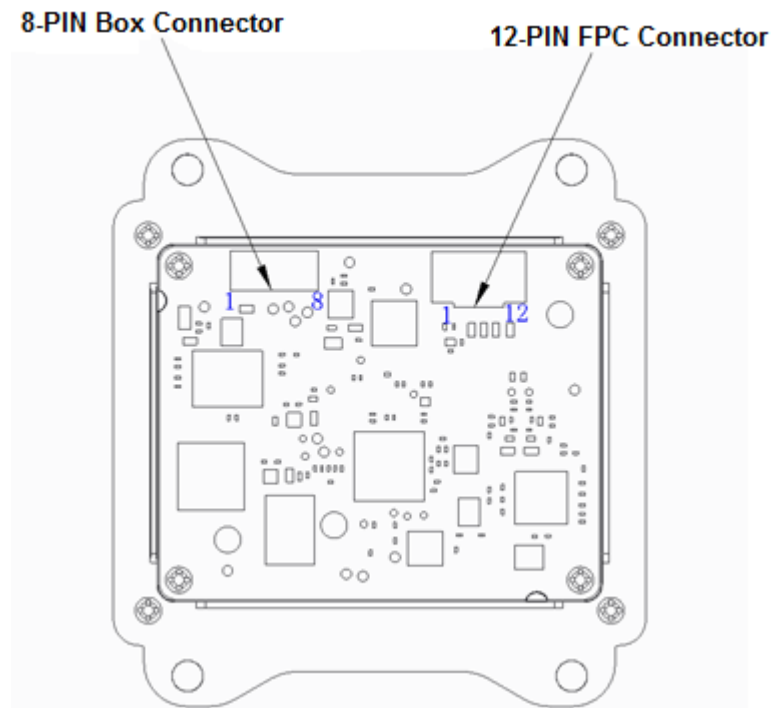


Figure 3-1

12-pin FPC Connector

The following table lists the pin functions of the 12-pin FPC connector.

Table 3-1

PIN#	Signal	I/O	State	Function	Remark
1	EXT_TRIG#	I	High Level	External trigger control signal (active low)	See Note 1
2	EXT_RST#	I	High Level	External reset control signal (active low)	See Note 2
3	EXT_DSF	O	Low Level	External good read LED control signal (active high)	See Note 3
4	EXT_BUZ	O	Low Level	External beeper control signal (active high)	See Note 4
5	NC	-	-	-	
6	USB_D+	Two-way	High Level	USB_D+ signal	
7	USB_D-	Two-way	Low Level	USB_D- signal	
8	TTL232_TX	O	High Level	TTL level 232 transmit data	
9	TTL232_RX	I	High Level	TTL level 232 receive data	
10	GND	Power Supply	-	Power-supply ground	
11	EXT_VCC	Power Supply	-	5V power supply input	
12	NC	-	-	-	

8-pin Box Connector

The following table lists the pin functions of the 8-pin box connector.

Table 3-2

PIN#	Signal	I/O	State	Function	Remark
1	EXT_VCC	Power Supply	-	5V power supply input	
2	GND	Power Supply	-	Power-supply ground	
3	EXT_TRIG#	I	High Level	External trigger control signal (active low)	See Note 1
4	EXT_BUZ	O	Low Level	External beeper control signal (active high)	See Note 4
5	USB_D+	Two-way	High Level	USB_D+ signal	
6	USB_D-	Two-way	Low Level	USB_D- signal	
7	RS232_TX	O	Low Level	RS-232 transmit data	
8	RS232_RX	I	Low Level	RS-232 receive data	

※ I = Input; O = Output

※ 1 This external trigger signal can be either level trigger or pulse trigger.

Level trigger: The trigger signal is generated via the external trigger pull or the external IO interface. A trigger pull activates a decode session (duration: ≥ 25 ms). Ensure the level of trigger signal maintains unchanged during the decode session.

Pulse trigger: When the trigger signal is detected, scanning is activated until a barcode is decoded or the decode session timeout expires (pulse width: ≥ 25 ms). The duration can be programmed. To learn how to program the parameter, please see the EM20-85 user guide.

For the external trigger circuit, please see the “Trigger Circuit” section in Chapter 5. If the EXT_TRIG# pin is not used, leave it unconnected.

※ 2 Giving a 20 μ s low pulse on the EXT_RST# pin of the 12-pin FPC connector will reset the engine. If this pin is not used, leave it unconnected.

※ 3 This output signal can be used by an external LED to indicate good read status.

The EXT_DSIF pin produces a high output (default duration: 20ms, user-programmable) when a good read occurs. To learn how to program these parameters, please see the EM20-85 user guide.

For the external LED circuit design, please see the “Good Read LED Circuit” section in Chapter 5. If the EXT_DSIF pin is not used, leave it unconnected.

※ 4 This output signal can be used by an external beeper circuit to generate audible feedback to the user to indicate power-on and good read statuses.

Power On beep: The EXT_BUZ pin produces a PWM output (duration: 400ms; frequency: 2090Hz, 2630Hz, 3130Hz and 4260Hz.) 215ms after power-on. The beep can be programmed On or Off. To learn how to program the parameter, please see the EM27 user guide.

Good Read beep: The EXT_BUZ pin produces a PWM output (default duration: 80ms; frequency: 2710Hz, 3940Hz, 4800Hz) when a good read occurs. Default frequency is 2710Hz. The beep can be programmed On or Off. To learn how to program these parameters, please see the EM27 user guide.

For the external beeper circuit design, please see the “Beeper Circuit” section in Chapter 5. If the EXT_BUZ pin is not used, leave it unconnected.

Connector/Cable Specifications (Unit: mm)

The EM20-85 is equipped with a 12-pin FPC connector and a 8-pin box connector.

12-pin FPC Connector

The 12-pin FPC connector on the EM20-85 is supplied by Shenzhen Mos Electronic Technology Co.,Ltd., Model No. 0.5-18-12PBX-AL-P.

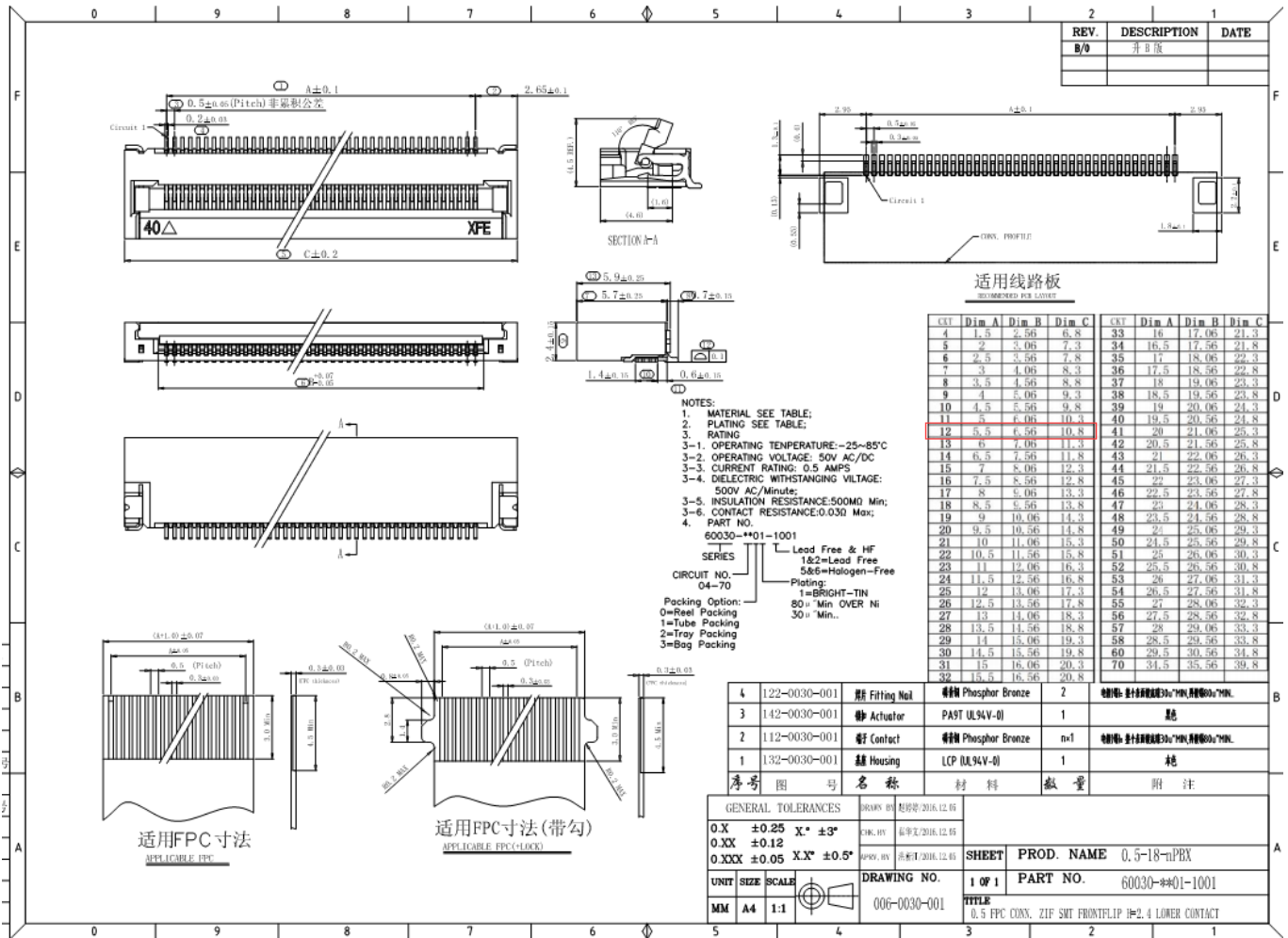


Figure 3-2

8-pin Box Connector

The 8-pin FPC connector on the EM20-85 is supplied by Xiamen PinToPin Electronic Technology Co.,Ltd., Model No. 1.0T-8AWB.

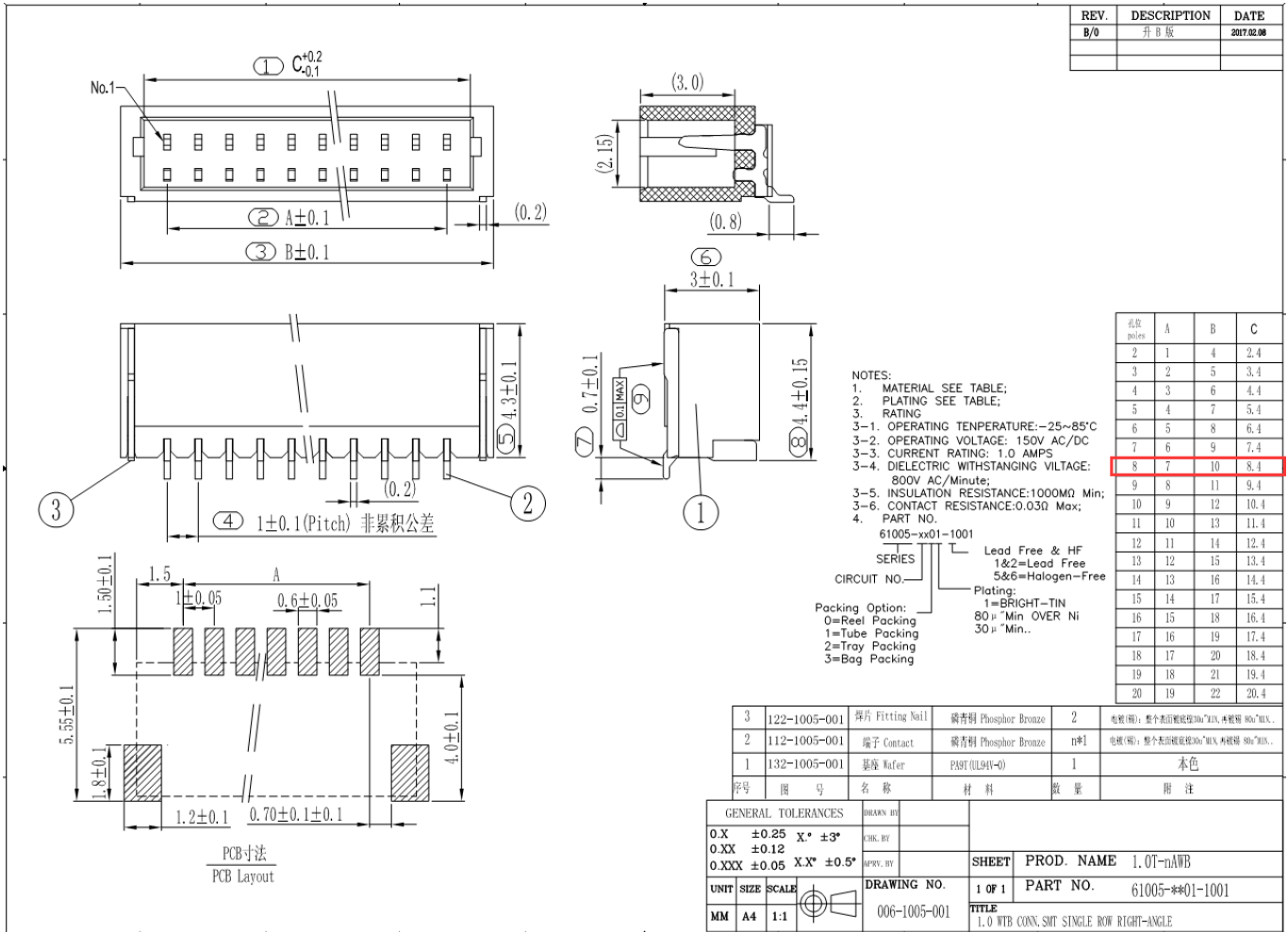


Figure 3-3

12-pin FPC Cable

A 12-pin FPC cable can be used to connect the engine's 12-pin FPC connector to a host device.

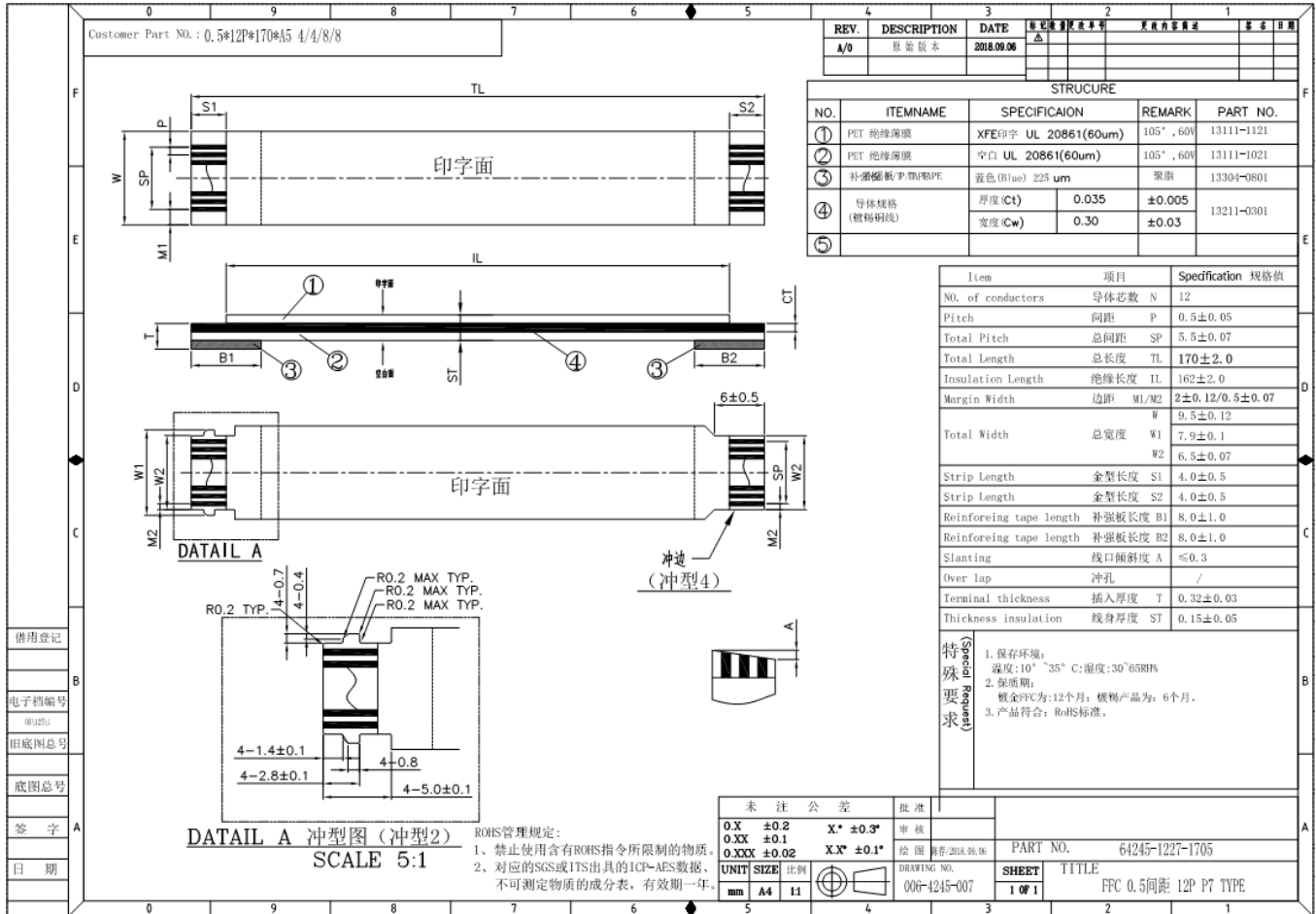


Figure 3-4

Dedicated Cable for 8-pin Box Connector

The dedicated cable can be used to connect the engine's 8-pin box connector to a host device.

Cable for 8-pin Box Connector (USB interface):

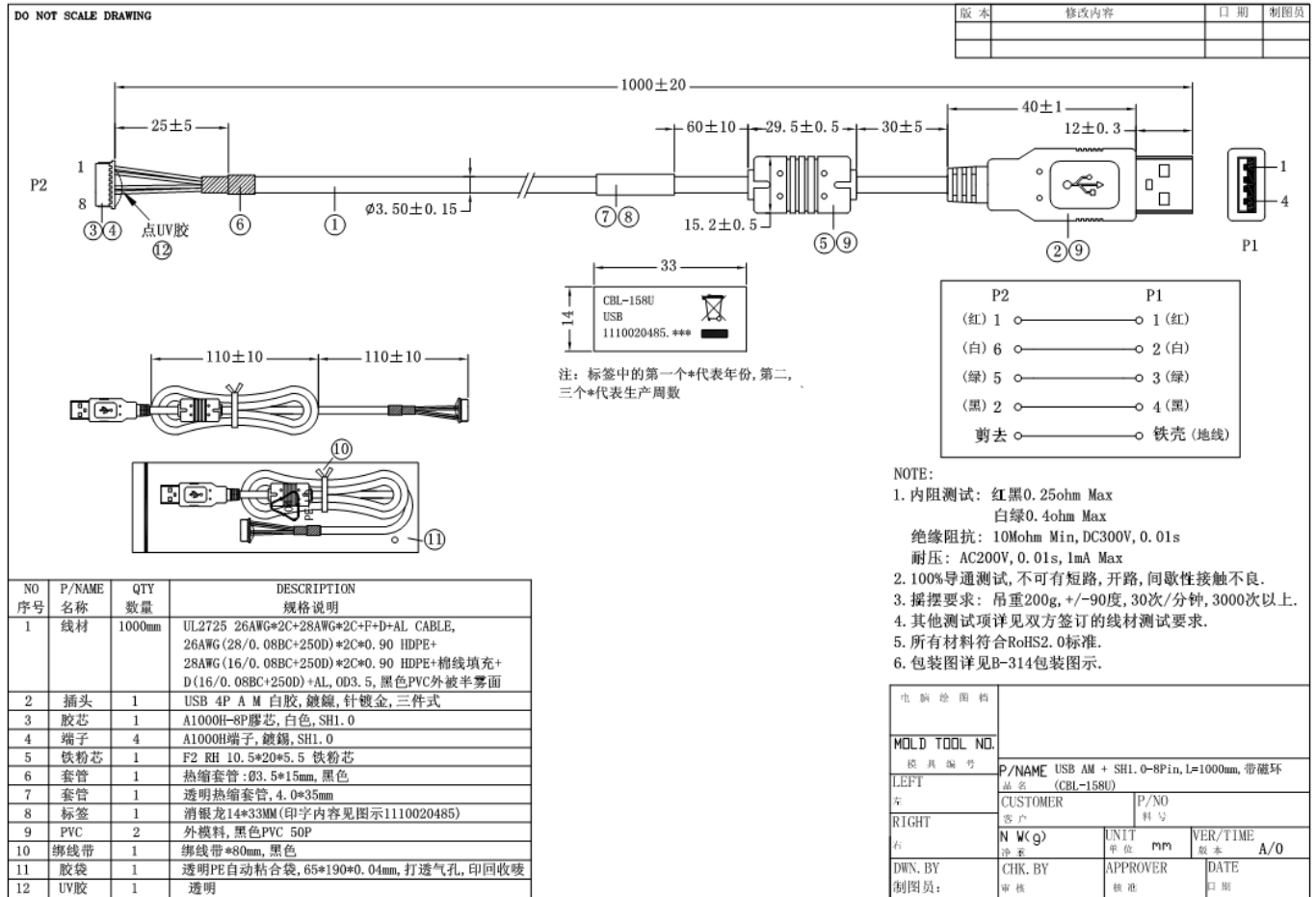


Figure 3-5

Cable for 8-pin Box Connector (RS-232 interface):

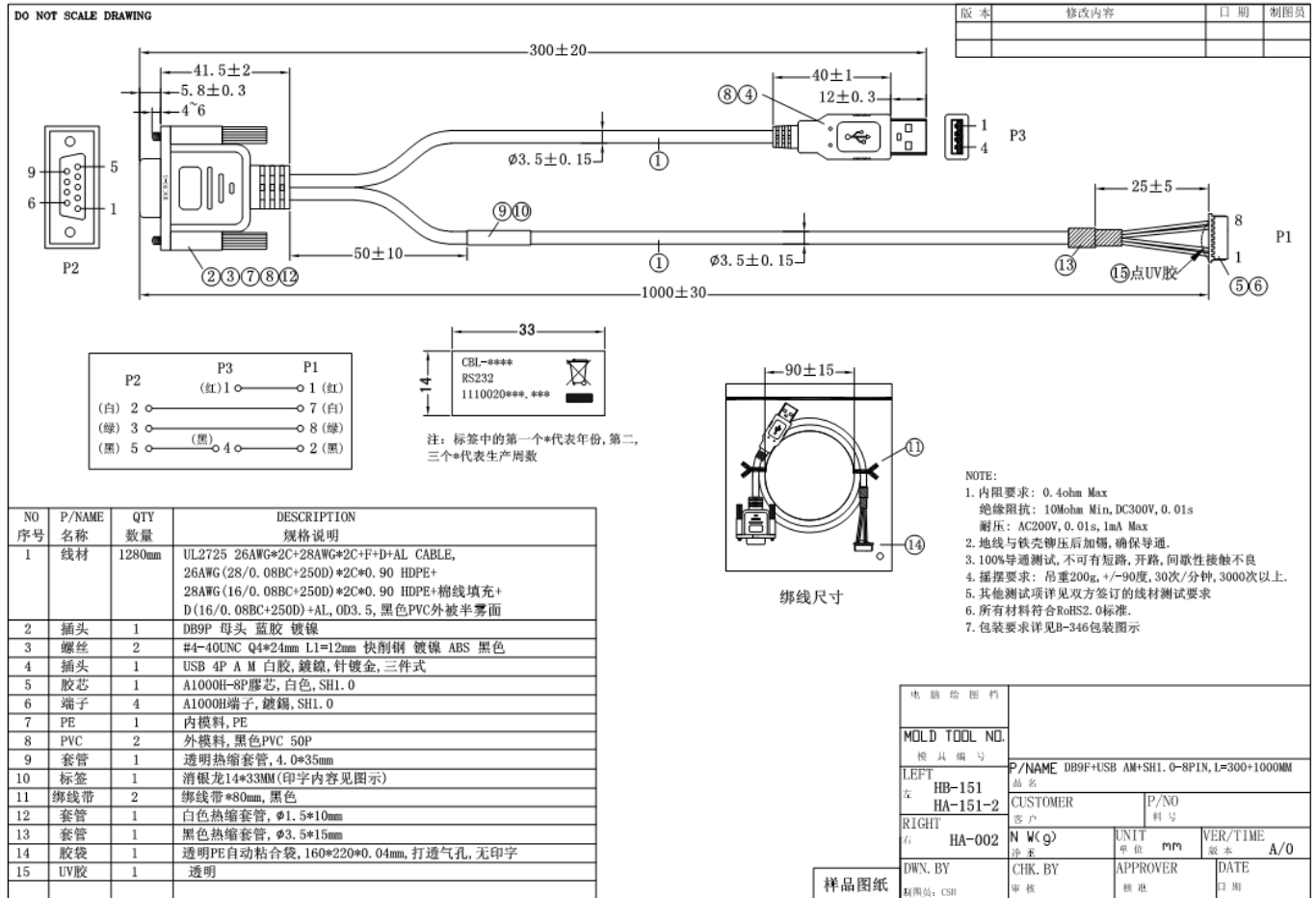


Figure 3-6

Chapter 4 Electrical Specifications

Power Supply

Do not power up the EM20-85 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.

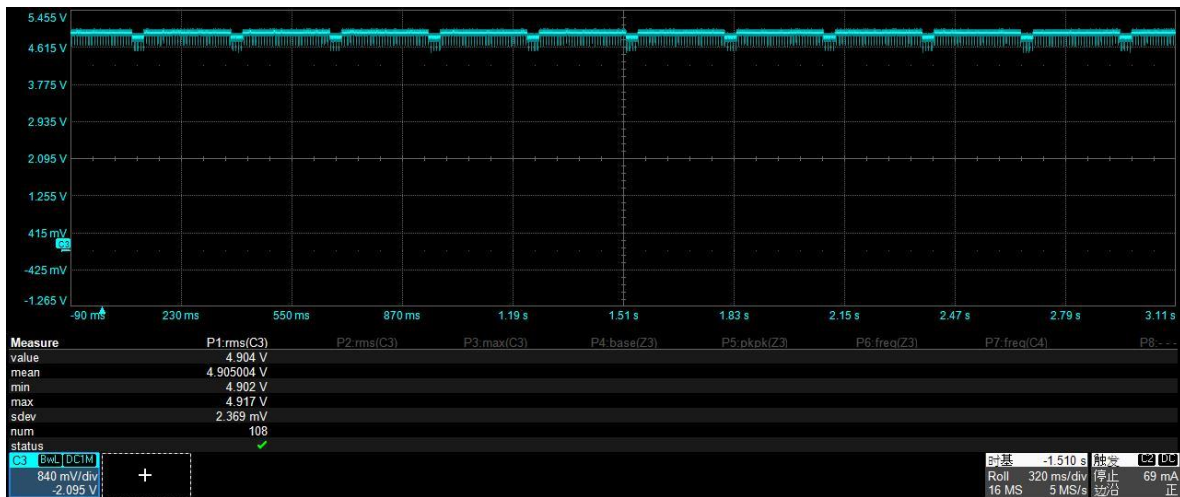
Unstable power supply or sharp voltage drops or unreasonably short interval between power-ons may lead to unstable performance of the engine. Do not resupply the power immediately after cutting it off.

DC Characteristics

Operating Voltage

Table 4-1

Parameter	Description	Minimum	Typical	Maximum	Unit
EXT_VCC	Input Voltage	4.75	5.0	5.25	V



EXT_VCC Waveform

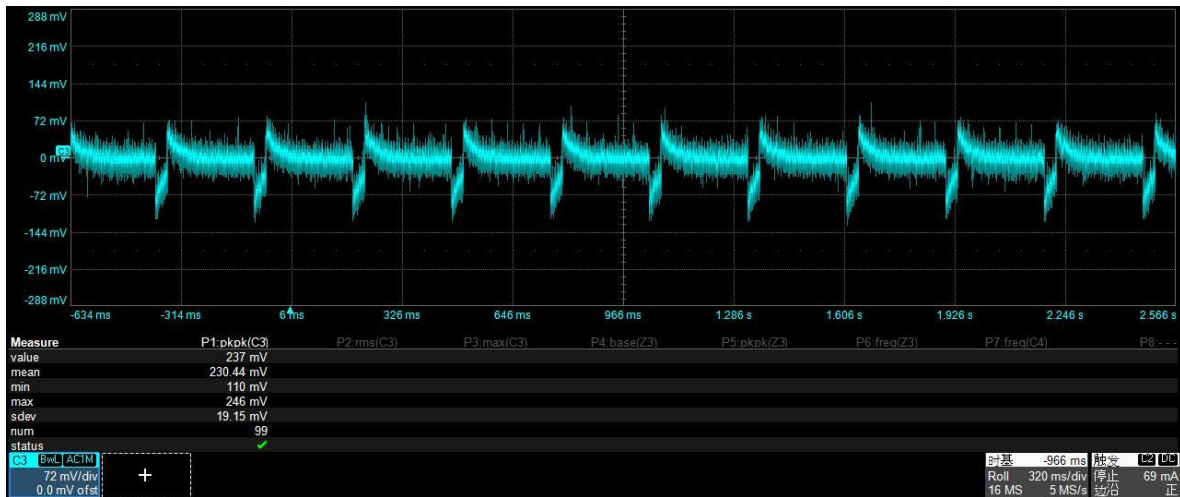
Figure 4-1

Ripple Noise

To ensure the image quality, a power supply with low ripple noise is needed.

Table 4-2

Parameter	Standard (pk-pk)	Unit
EXT_VCC	≤250	mV



EXT_VCC Ripple

Figure 4-2

I/O Voltage

Table 4-3

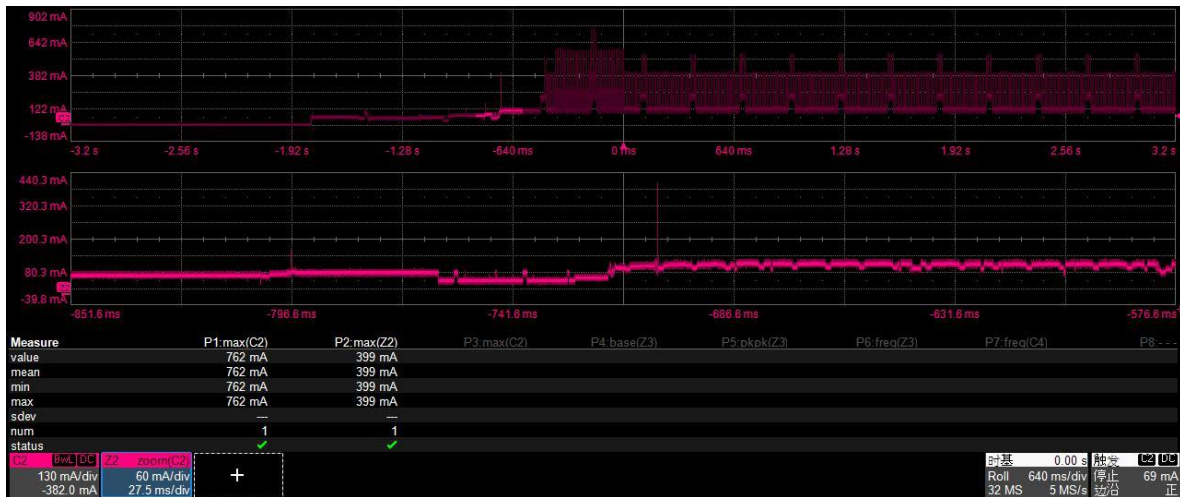
Parameter	Condition	Minimum	Typical	Maximum	Unit
VIL	Low Level Input Voltage	- 0.3	0	0.8	V
VIH	High Level Input Voltage	2.0	3.3	3.6	V
VOL	Low Level Output Voltage	- 0.3	0	0.4	V
VOH	High Level Output Voltage	2.4	3.3	3.6	V

Operating Current

Table 4-4

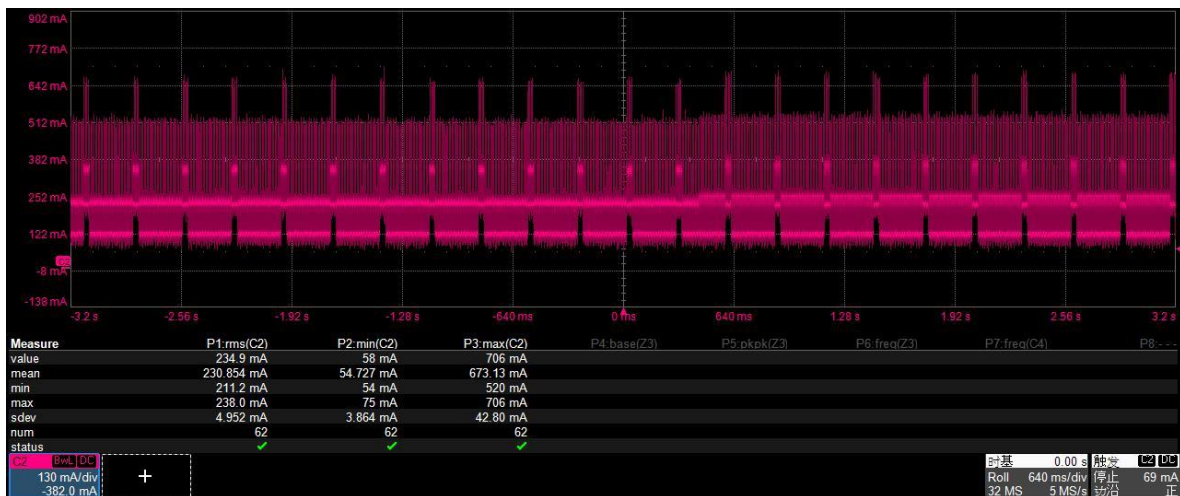
@VCC=5.0V@25°C

Description	State	Peak Current	I_{rms}	I_{max}	Unit
Working Current	VDD=5.0V (with NFC)	762	230.8	706	mA
Standby Current			107.3	219	mA
Working Current	VDD=5.0V (without NFC)	551	196.6	542	mA
Standby Current			29.6	52	mA



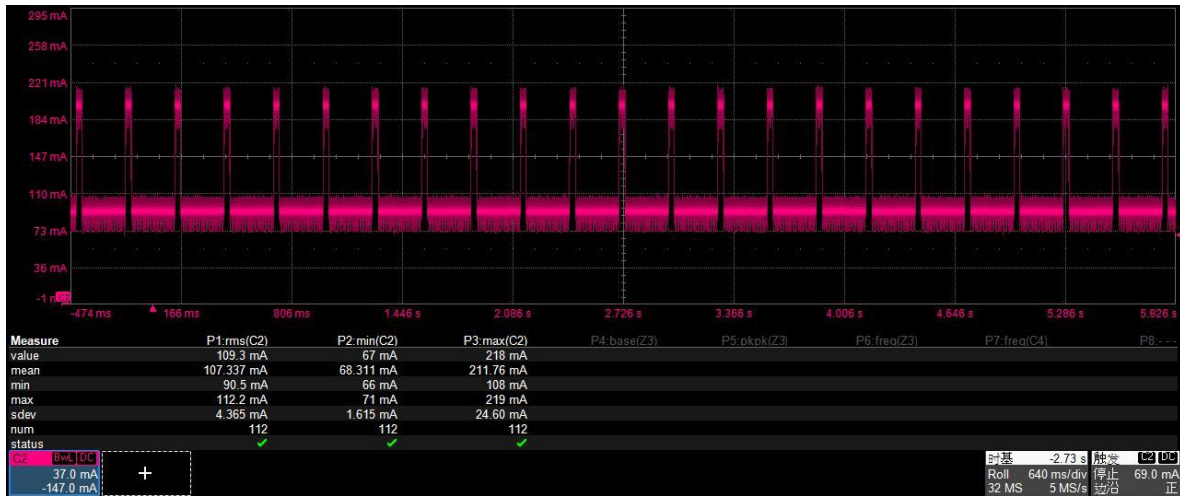
Peak Current (VDD=5.0V, with NFC)

Figure 4-3



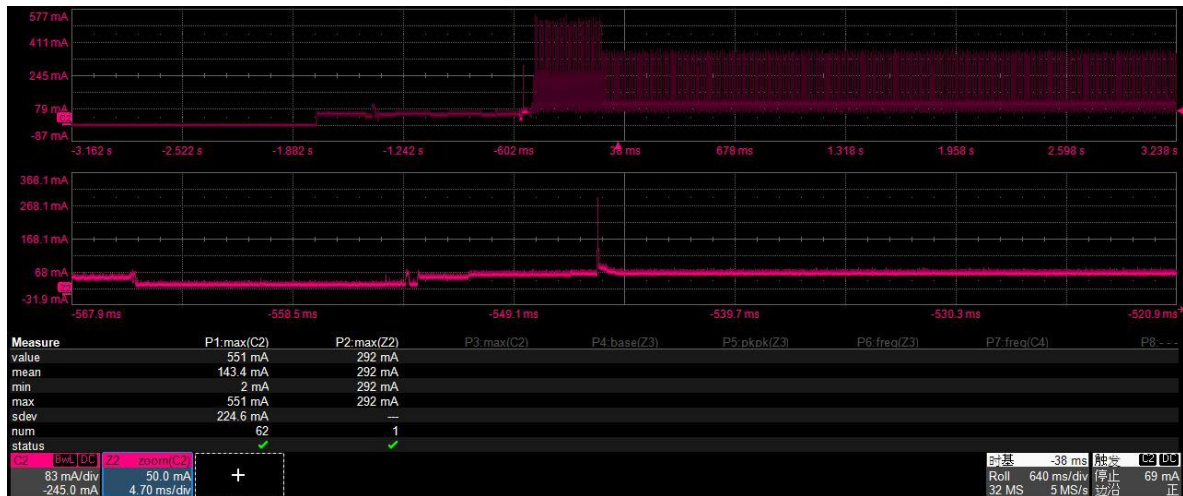
Working Current

Figure 4-4



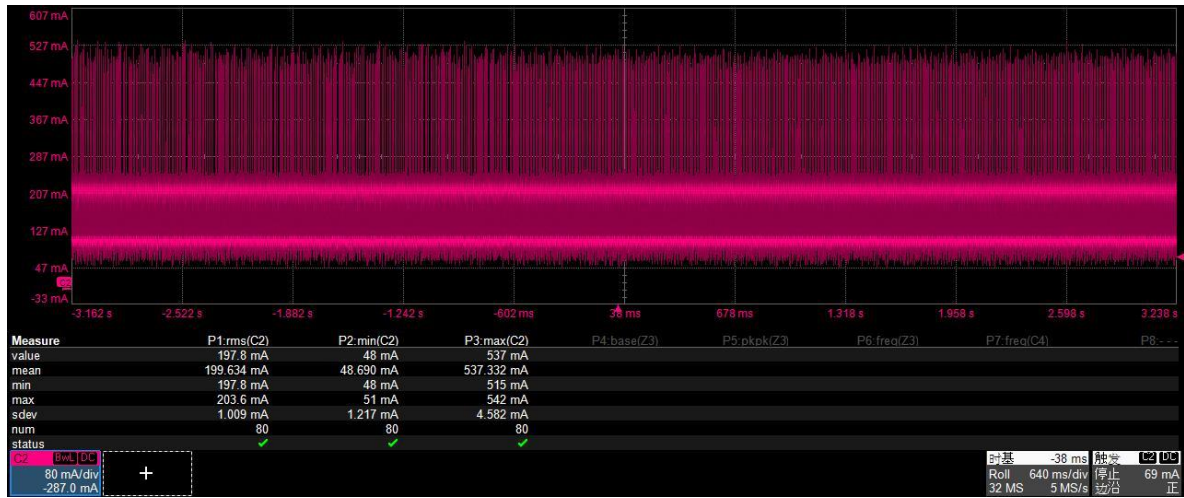
Standby Current

Figure 4-5



Peak Current (VDD=5.0V, with NFC)

Figure 4-6



Working Current

Figure 4-7



Standby Current

Figure 4-8

Timing Sequence

Power Up and Power Down Timing Sequence

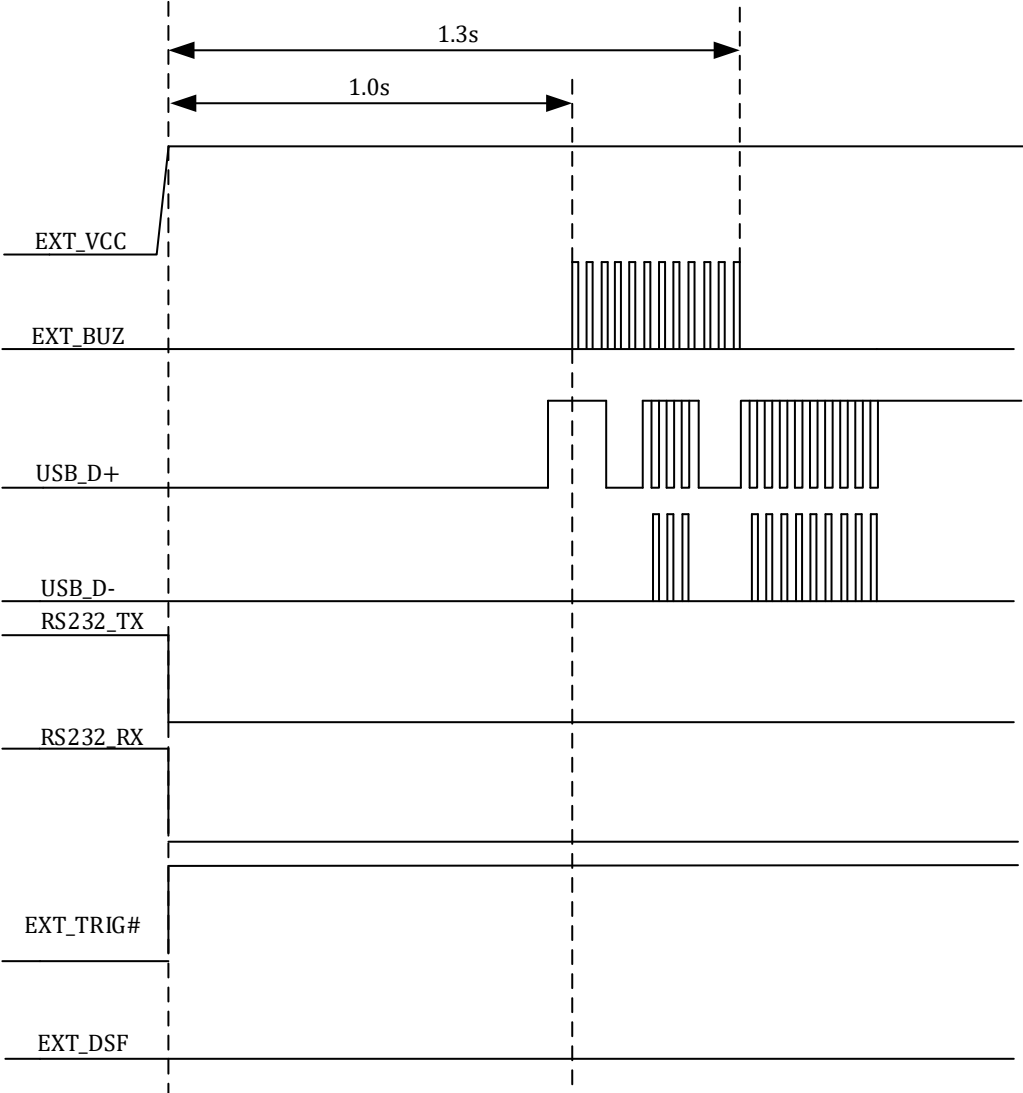
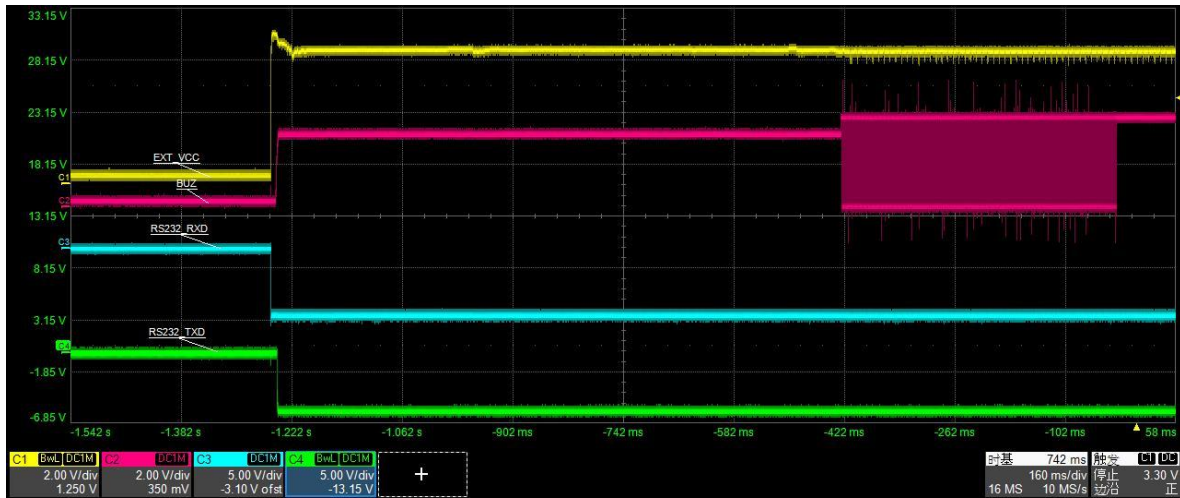


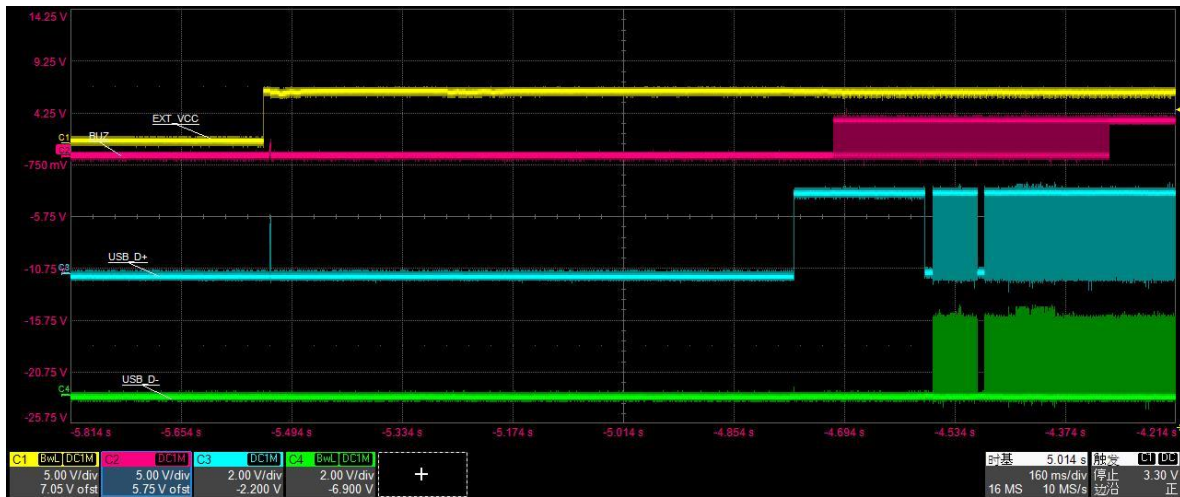
Figure 4-9
(8-pin box connector, without NFC)

1. In the diagram above, it takes about 1s to initialize the engine. Operate the engine via the host 1.3s later after the engine is powered on.
2. Before powering off the engine, ensure that data transmission via its communication interface(s) is complete to prevent transmission errors.
3. Before the EXT_VCC is powered on, ensure that other signals remain low to prevent current from flowing backwards to affect the performance of the engine.



Serial Communication Waveform

Figure 4-10



USB Communication Waveform

Figure 4-11

Chapter 5 External Reference Circuit

External Circuit Design

Good Read LED Circuit

The circuit below is used to drive an external LED for indicating good read.

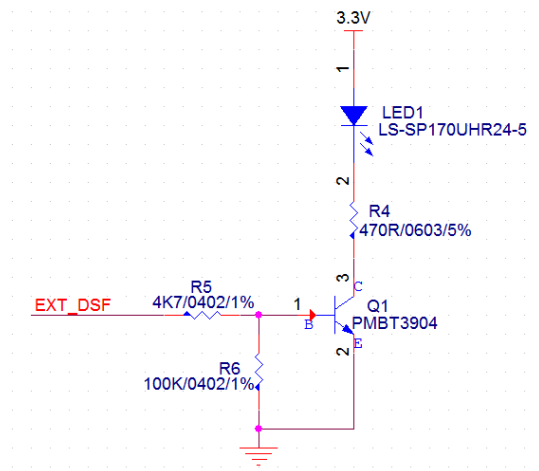


Figure 5-1

Beeper Circuit

The circuit below is used to drive an external beeper.

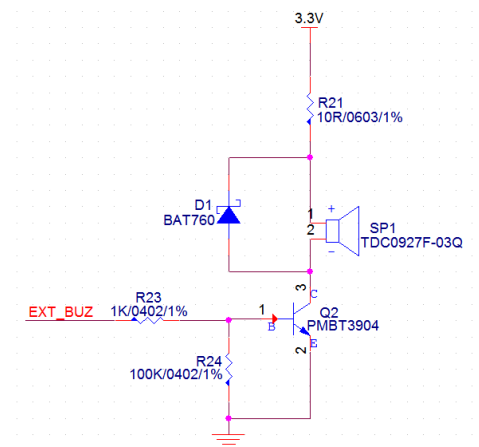


Figure 5-2

Trigger Circuit

The circuit below is used to provide the engine with a signal to trigger a scan and decode session.

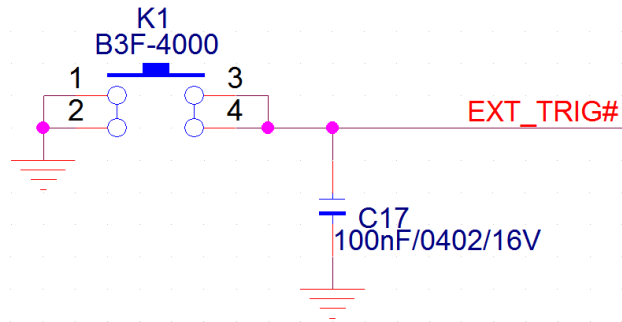


Figure 5-3

Chapter 6 Auxiliary Tool

The EM20-85 provides the following tool to assist users in engine configuration.

EasySet

EasySet is a Windows-based configuration tool developed by Newland, which can be used to configure the EM20-85.



Newland

SCANNING MADE SIMPLE

Newland EMEA HQ
+31 (0) 345 87 00 33
info@newland-id.com
newland-id.com

Need more info? Contact us or one of
our partners at newland-id.com/partners