Decoded Engine DE01
Hardware Integration Guide
Version 1.01

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Revision History

Version	Date	Description
1.0	09/09/17	Original Version
1.01	01/02/20	Updates defining UART

Table of Contents

About this Manual

This Hardware Integration Guide provides opto-mechanical details, and hardware design considerations in integrating the DE01 scan engine (referred to as "scan engine" or "OEM scan engine") specifically into OEM integrated scanning applications.

DE01 family includes three models, see Appendix A Part Numbers for the ordering codes.

- •Decoded UART.
- •Decoded USB HID Keyboard.
- •Undecoded.

Manual Conventions

The following conventions are used in this document:

The symbols listed below are used in this manual to notify the reader of key issues or procedures that must be observed when using the reader:

Notes contain information necessary for properly diagnosing, repairing and operating the reader.

CAUTION **The CAUTION symbol advises you of actions that could damage equipment or property.**

About the DE01

The DE01 is an ultra compact, high performance linear CCD scan engine family used to decode linear barcodes and to transmit the decoded information to a host by means of a UART, or USB HID Keyboard interface.

Unpacking the Scan Engine

The scan engine is shipped in custom packaging. Carefully open the package, and inspect for the following:

•scan engine

If any parts are damaged or you need additional hardware, please contact Technical Support.

Scan Engine Care

The scan engine contains sensitive components which require special handling.

•Do not disassemble the scan engine. Doing so will void the warranty.

•Use standard ESD precautions & policies when handling the DE01 scan engine.

External Optics

The engine has an exposed illumination system on the outer surfaces. Take care in handling the optical components, and avoid mechanical stress which may damage the lens. Avoid touching the optical surfaces to preserve the optical performance.

System Overview

The DE01 scan engine family features a 2500 pixel linear CCD sensor, able to capture images up to 600 FPS. All the engine models contain an embedded illumination system based on a green LED source that allows the reader to create a laser like illumination line which is easily visible to the user. A high performance, low power micro-controller runs the engine system, decodes barcode data, and handles communication with the external host. The host interface is a 10-pole zif connector. Electrical interface on the connector is specific to the model of DE01 being used.

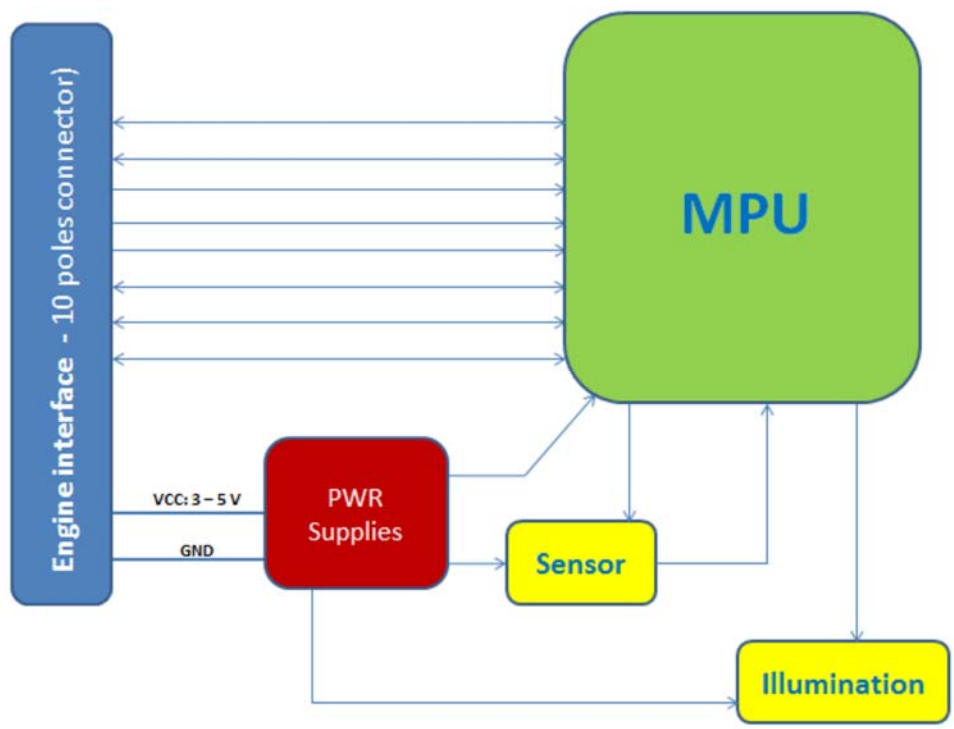


Figure 1. Engine Block Diagram

Illumination and Aiming System

The Illumination System is comprised of one green LED and non-imaging optics designed to provide first-class reading performances, even in total darkness or in the presence or bright light.

Regulatory

IEC 62471 Exempt risk group.

Aiming Pattern

The green LED illuminator also provides a highly visible aiming guide for the user.

Chapter 1 Installation

This section describes the design of the mounting for optimum scan engine performance.

Mounting the Scan Engine

General Considerations

A typical system uses the scan engine mounted inside a host enclosure, with an opening for the illumination system light to exit and illuminate labels to read bar codes. The opening should be the size of the scan engine field of view at a minimum, but limited to reduce exposure of the scan engine to the environment.

It is important to consider the effect of the environment on the scan engine. In particular, mounting should minimize the possibility of foreign objects coming into contact with the electronics. Such contact could damage the device or reduce the scan engine's performance.

Mechanical Size

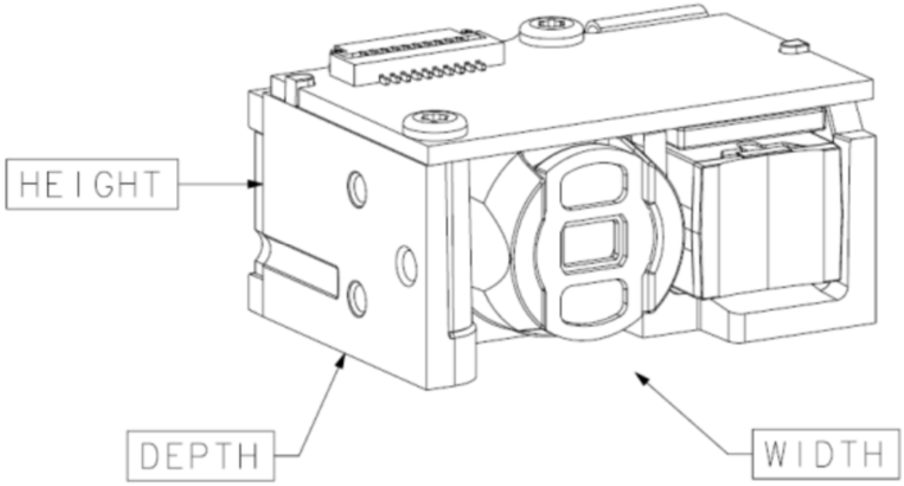


Figure 2. Nominal Engine Size

Nominal size:

21 mm (width) x 11.4 mm (height) x 15.2 mm (depth)

Maximum size:

21.6 mm (width) x 11.65 mm (height) x 15.5 mm (depth)

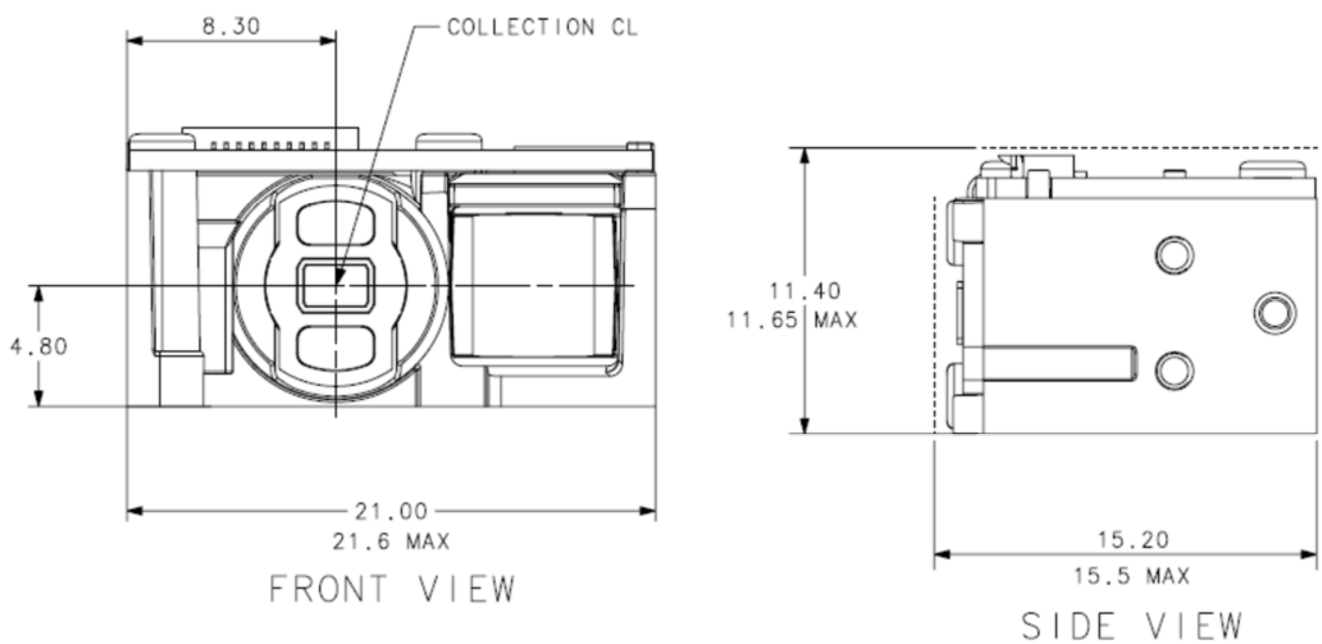


Figure 3. Engine Size

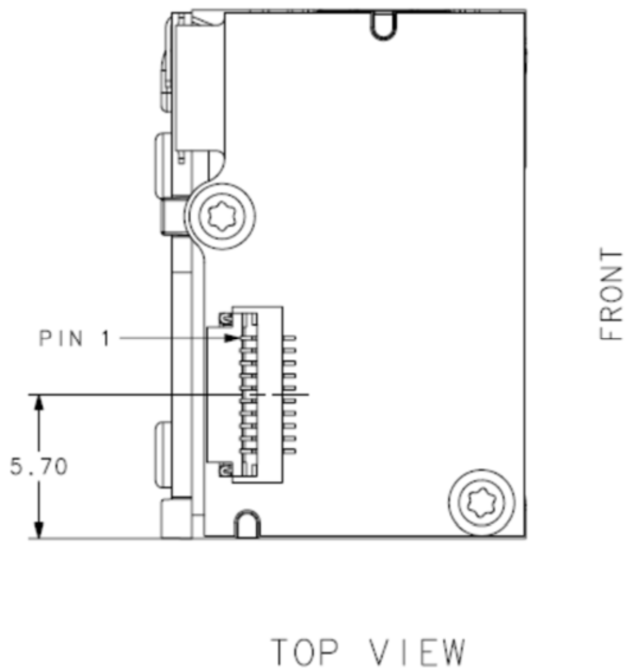


Figure 4. Connector Position

Mounting Holes

There are two M1.6x0.35mm mounting holes located on the bottom of the chassis (holes marked with "A", see Figure 5). The recommended mounting torque is 0.15 Nm.

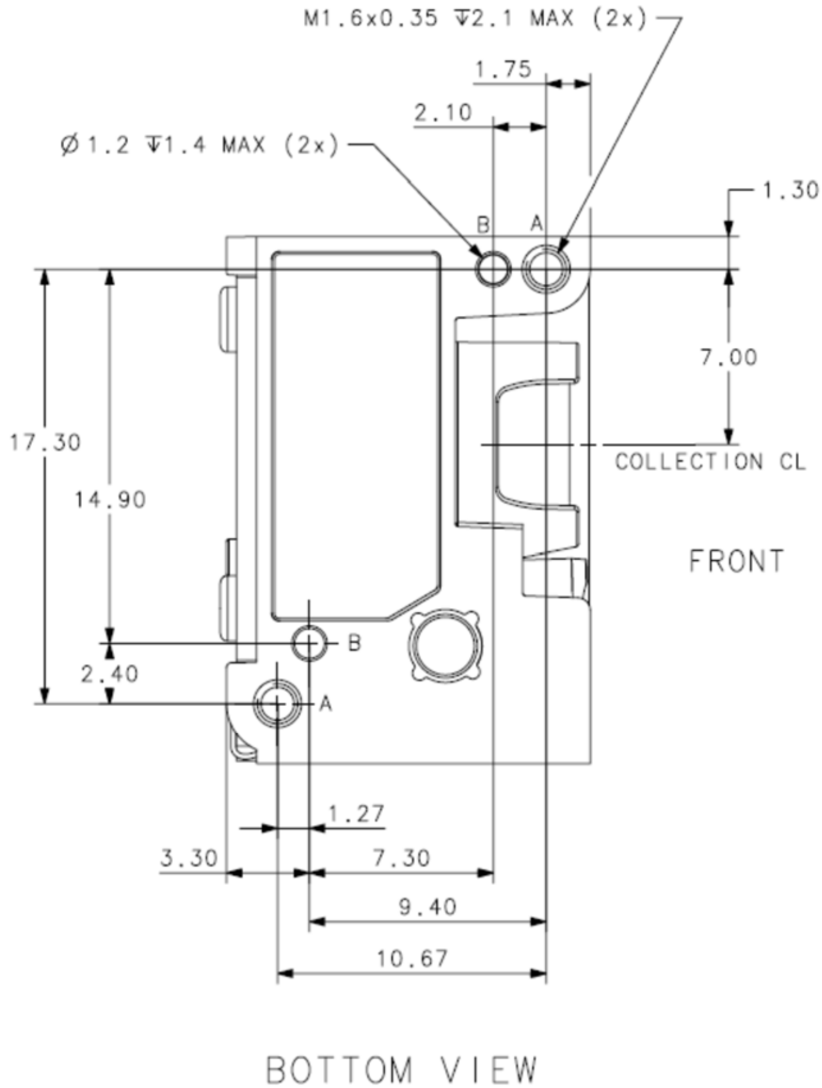


Figure 5. Mounting Holes and Related Requirements

Housing Design

The enclosure must be designed to prevent internal reflections from illumination and aiming systems into the receiving optics. The exit window must be properly positioned and tilted to avoid reflections that could limit engine performance, both for decoding and image capture.

Positioning the exit window

There are two options for positioning the exit window with respect to the engine optical axis:

- Perpendicular

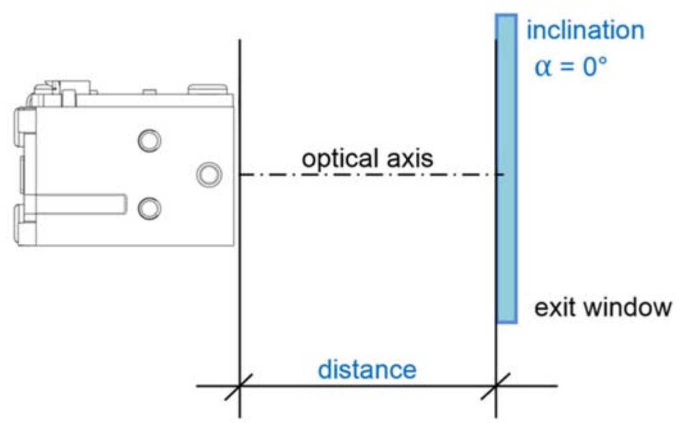
• Tilted

Distances are measured from the illumination lenses to the first face of the exit window (the nearest to the engine). Window thickness should be smaller or equal to 1.5mm.

The use of a double-sided AR coated exit window is strongly recommended both for perpendicular and tilted windows.

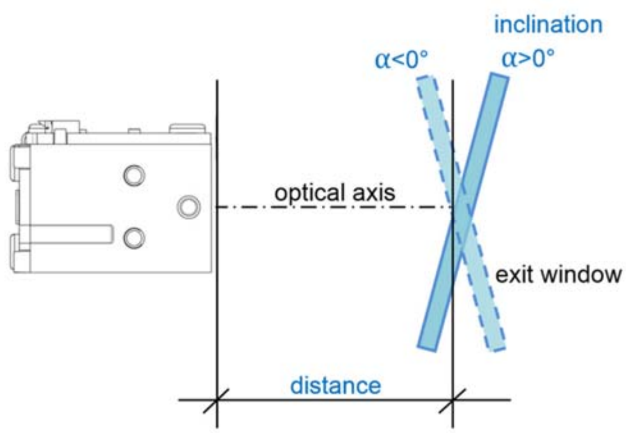
Notes:

- Do not place the exit window between the maximum distance allowed for a parallel window (Figure 6) and the minimum distance for a tilted window (Figure 7).
- Integration tolerances are not included.



	Distance [mm]
No Coating	< 1 mm
AR coating (2 sides)	< 3 mm

Figure 6. Exit Window Positioning – Perpendicular Window



		Distance [mm]					
		5	**10**	**15**	**20**	**25**	**30**
No Coating	+α	22°	24°	24°	22°	14°	14°
	−α	22°	24°	24°	22°	14°	14°
AR coating (2 sides)	+α	14°	12°	12°	10°	10°	10°
	−α	14°	12°	12°	10°	10°	10°

Figure 7. Exit Window Positioning – Tilted Window

Avoiding Scratched Windows

Scratches on the exit window can strongly affect the reading performance. It is recommended to use an exit window having a scratch-resistant coating and to position the engine window in a recessed position.

Window Material

The exit window is an integral part of the imaging system and should be designed and selected to preserve the optical quality of the system. It is recommended to use only cell-cast plastics or optical glass. Common materials and their characteristics are shown in Table 1 below.

Properties	PMMA (cell cast acrylic or polymethyl methacrylic)	CR39 (Allyl Diglycol Carbonate)
Optical Quality	Very good	Very good
Surface Hardness	Hard coating required	Hard coating required
Impact Resistance	Good	Good
Chemical / UV Resistance	Susceptible	Susceptible
Ultrasonically Welding	Compatible	Compatible

Table 1. Exit Window Materials

Exit Window Properties

Recommended properties/performance of the exit window are reported in Table 2 below.

Material	PMMA or CR39 or equivalent
Thickness	1.5mm
Wavefront distortion	0.2 wavelengths peak-to-valley maximum and 0,04λ maximum rms over any 2.0mm diameter within the clear aperture
Clear aperture	To extend to within 1.0mm of edges all around
Surface quality	60/20 scratch/dig
AR coating	• double sided • transmittance > 97% minimum within spectrum range 400nm-750nm. • reflections max 0,4% per side in the range 620nm-640nm

Table 2. Exit Window Properties

Optical Paths and Exit Window Clearance

Figure 8 and Figure 9 show the optical paths for the imaging system and the illumination system.

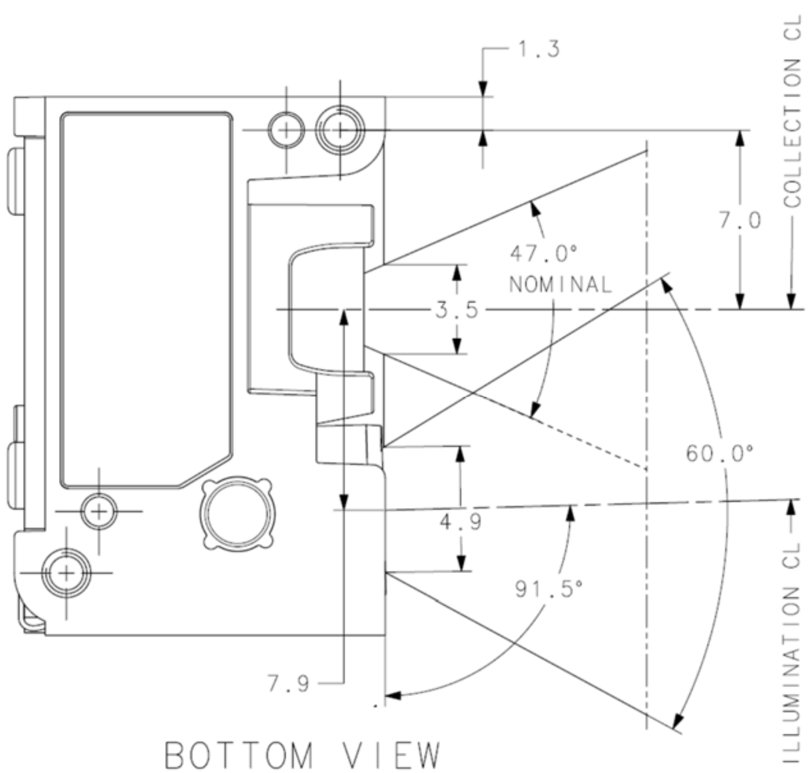


Figure 8. Bottom View - Aiming, Imaging and Illumination Optical Paths

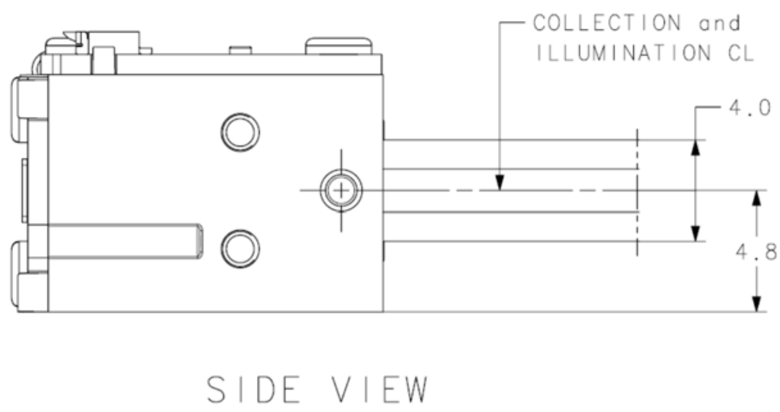


Figure 9. Side View - Aiming, Imaging and Illumination Optical Paths

Illumination and Collection center lines are nominally aligned on the vertical plane and they are also parallel to the bottom side of the engine (see Figure 9- side view). However, assembly tolerances may cause a displacement between the 2 lines and the engine itself.

Figure 10 shows the real mutual position of illumination and collection center lines and the corresponding tolerances.

- Maximum displacement between the 2 lines (A) is +/- 0.2°.
- Maximum displacement with respect to the mounting of the scan engine (B) is +/- 1.5°.

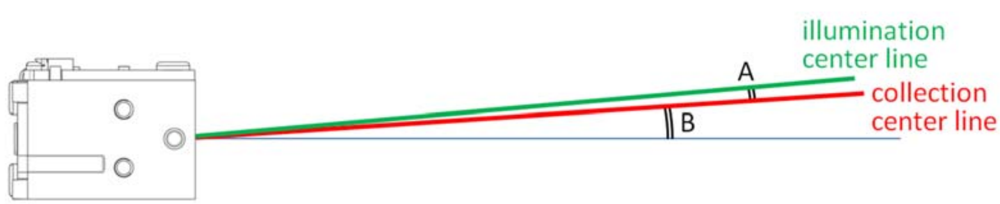


Figure 10. Illumination and Collection Center Line Position

Environment

Dust on the optical parts of the engine can badly affect the performance of the scan engine. Ensure the engine is clear of dust and water when integrating it inside a housing.

Chapter 2 Electrical Integration

Supply Voltages and I/O levels

Item	Level	Description
VCC	3.0V – 5.0 V	The engine full operation is guaranteed in this range of voltage (compatible with USB powering).
I/O level	VOH min = 2.6 V VOH nom = 3.0 V	The driving capability of the output pins is 4 mA max. The internal engine digital supply is 3.0 V. The I/O output voltage is 3.0 V nominal. All the inputs are 5 V tolerant if the engine is powered with VCC. If the input pin 2 is not powered, the inputs must be not driven high.

Table 3. Supply Voltages and I/O Levels

Power Supply Noise

To preserve image quality (both for decoding and image capture applications), a low-noise power supply is required. The requirement for the power supply peak-to-peak noise is ≤150mV (the lower the better).

Electrical Connections

Grounding

The chassis of the engine is at ground potential. Mounting screws can be used to implement additional connections to the host ground.

Based on the host characteristics, the additional ground connections can affect:

- the engine performance (if noise is injected into the scan engine)
- the radiated emission (depending on current loops)

These topics should be reviewed at the beginning of the integration process.

ESD

The engine is protected from ESD up to ±2.0Kv@ connector.

During installation it is recommended to apply standard ESD handling procedures, such as operating in a properly grounded working area using wrist straps.

Electrical Interface

The DE01 scan engine family can be connected to the external host system via a 10-pole ZIF connector supporting:

- decoded information transmitted by means of serial UART interface
- decoded information transmitted by means of USB HID Keyboard interface (referred to as decoded USB)
- raw undecoded information transmitted to the host by means of VIDEO and SYNC signals.

Signals on the host connector are mapped based on the model of DE01 being used. .

Table 4 below describes the power lines and the signals mapped on the 10-pole ZIF connector for decoded UART model.

Table 5 below describes the power lines and the signals mapped on the 10-pole ZIF connector for USB HID Keyboard model.

For supply voltages and IO levels see Table 3 in the previous section.

Pin	Signal	I/O type	Description
1	UART_TX	O	UART transmission port.
2	VCC	power	Main power supply.
3	CTS (if function enabled)	I	Internal pull up to VCC with a 180K.
4	nILLUMINATION_ENABLE	I	Active low external 100 K pull to VCC required (1).
5	nSCAN_ENABLE	I	Active low external 100 K pull to VCC required (2).
6	LED_CTRL2/BEEP	O	Push pull PWM out to a beeper circuit.
7	LED_CTRL1	O	Push pull out to a LED circuit.
8	RTS (if function enabled)	O	If not in use, external pull up to VCC with a 100K required.
9	GND	power	Main power ground.
10	UART_RX	I	UART receiving port (3).

Table 4. Engine Connector Description UART interface

1. UART_TX: direction OUT, UART transmission port.

2. VCC: main power supply, 3.3V nominal is suggested, nominal current during normal operation approximately 150 mA.

3. CTS: (if function enabled) direction IN, internal pull up to VCC with a 180 K resistor.

4. nILLUMINATION_ENABLE: direction IN, active low, external pull up to VCC with a 100 K resistor required. When this signal is driven to 0 the engine starts a scanning and decoding session. Once the code is decoded, the illumination is switched off by the engine. To start another scanning session, the host must generate another falling edge on this signal. NOTE (1): The scanning phase can be also activated by the specific UART command.

5. nSCAN_ENABLE: direction IN, active low, external pull up to VCC with a 100 K resistor required. When this signal is high the engine is in LOW POWER mode. In LOW POWER mode the nILLUMINATION_ENABLE is ignored. In order to start normal operation, drive this signal to 0. NOTE (2): The engine can also enter in LOW POWER mode by means of the specific UART command. A UART NULL character is also interpreted as exit LOW POWER mode, switching the engine to normal operation.

6. LED_CTRL2/BEEP: direction OUT, push pull, idle low, PWM out to a beeper control. This output cannot supply current; it is designed to drive a transistor connected to the beeper.

7. LED_CTRL1: direction OUT, push pull, idle low, out to a LED control. This output cannot supply current, it is designed to drive a transistor connected to a decode LED.

8. RTS: (if function enabled) or RESERVED, direction OUT if enabled, external pull up to VCC with a 100 K resistor required if not in use.

9. GND: main power GND.

10. UART_RX: direction IN, UART receiving port.

NOTE (3): During LOW POWER this signal must be steady. A transition on this signal wakes up the engine.

Signals 6 and 7 are driven when the engine decodes a label.
UART default settings are 115200 baud, 8 data bits, No partity, 1 stop bit.

Pin	Signal	I/O type	Description
1	LED_CTRL1	O	Push pull out to a LED circuit.
2	VCC	power	Main power supply.
3	RESERVED	I	Do not use, internal pull up to VCC with a 180K.
4	nILLUMINATION_ENABLE	I	Active low external 100 K pull to VCC required (1).
5	nSCAN_ENABLE	I	Active low external 100 K pull to VCC required (2).
6	USB_D-	O	D- USB signal.
7	USB_D+	O	D+ USB signal.
8	LED_CTRL2/BEEP	O	Push pull PWM out to a beeper circuit.
9	GND	power	Main power ground.
10	RESERVED	I	Do not use, external pull up to VCC with a 100K required.

Table 5. USB HID Keyboard: Engine Connector Description

1. LED_CTRL1: direction OUT, push pull, idle low, out to a LED control. This output cannot supply current, it is designed to drive a transistor connected to a decode LED.

2. VCC: main power supply, 3.3V nominal is suggested, nominal current during normal operation approximately 150 mA.

3. RESERVED: direction IN, internal pull up to VCC with a 180 K resistor.

4. nILLUMINATION_ENABLE: direction IN, active low, external pull up to VCC with a 100 K resistor required. When this signal is driven to 0 the engine starts a scanning and decoding session. Once the code is decoded, the illumination is switched off by the engine. To start another scanning session, the host must generate another falling edge on this signal.

5. nSCAN_ENABLE: direction IN, active low, external pull up to VCC with a 100 K resistor required. When this signal is high the engine is in LOW POWER mode. In LOW POWER mode the nILLUMINATION_ENABLE is ignored. To start normal operation, drive this signal to 0.

6. USB_D-: USB D- signal.

7. USB_D+: USB D+ signal.

8. LED_CTRL2/BEEP: direction OUT, push pull, idle low, PWM out to a beeper control. This output cannot supply current, it is designed to drive a transistor connected to the beeper.

9. GND: main power GND.

10. RESERVED: direction IN, external pull up to VCC with a 100 K resistor required.

Pin	Signal	I/O type	Description
1	I2C_CLOCK	I/O bi-dir	I2C interface clock.
2	VCC	power	Main power supply.
3	nAIM_ENABLE	I	Do not use, internal pull up to VCC with a 180K.
4	nILLUMINATION_ENABLE	I	Active low external 100 K pull to VCC required (1).
5	nSCAN_ENABLE	I	Active low external 100 K pull to VCC required (2).
6	VIDEO	O	Digital representation of bar pattern
7	SYNC	O	Synchronization with the start of scan. Signals that a new scan has been started.
8	RESERVED	-	Do not use, reserved for future use.
9	GND	power	Main power ground.
10	I2C_DATA	I/O bi-dir	I2C interface data.

Table 6. Undecoded: Engine connector description

1. I2C_CLOCK: direction IN/OUT, open drain, I2C clock, external pull up 4,7K minimum required.

2. VCC: main power supply, 3.3V nominal is suggested, nominal current during normal operation is approximately 150 mA.

3. nAIM_ENABLE: direction IN, internal pull up to VCC with a 180 K resistor. State machine management. When the engine is active, pulling low this input activates the aiming.

4. nILLUMINATION_ENABLE: direction IN, active low, external pull up to VCC with a 100 K resistor required. When this signal is driven to 0 and the nAIM_ENABLE is high the engine starts a scanning session.

5. nSCAN_ENABLE: direction IN, active low, external pull up to VCC with a 100 K resistor required. When this signal is high the engine is in LOW POWER mode. In LOW POWER mode the nILLUMINATION_ENABLE and the nAIM_ENABLE are ignored. To start normal operation drive this signal to 0.

6. VIDEO: Digital representation of the digitized bar pattern, direction OUT, push pull, this is the digital representation of the barcode. The white to black is represented by a rising edge of DBP, while the black to white is represented by a falling edge of DBP. The distance in time between rising edge and falling edge of DBP signal is the bar dimension to be sent to the decoder.

7. SYNC: Synchronization with the start of scan, direction OUT, push pull, this signal represents the start of the scanning phase. Either a rising edge or a falling edge must be interpreted as start of

scanning phase. This signal is used to inform the decoder/acquisition system that a new scan started.

8. RESERVED: Reserved for future use. It can be either driven high/low, ground, or left floating. Suggestion is a 100KOhm pull-up resistor, in order to allow for eventual additional features yet to be implemented

9. GND: main power GND.

10. I2C_DATA: direction IN/OUT, open drain, I2C data, external pull up 4,7K minimum required.

Connector and Flat Cable

The DE01 scan engine is equipped with a 10-pole ZIF connector having a pitch of 0.5mm – series 6299 from Kyocera - ordering code 04 6299 610 020 846+. Mates to this can be used in addition the .3mm cable can be accommodated on the host with Molex 512811094 and 527451097. The designer should take care to note the connections through the ribbon cable correctly.

For further details and requirements related to the flat cable, please refer to the manufacturer's datasheet.

In order to reduce radiated emissions it is strongly recommended to adopt an EMI-shielded flat cable.

Powerup Sequence

In order to guarantee the correct operation of the engine, it is mandatory to use the following power-up sequence timing constraints:

- VCC must be applied for at least 5 ms before applying any voltage greater than 0 to the I/O interface pins.
- All the inputs are 5 V tolerant if the engine is powered with VCC. If the input pin 2 is not powered, the inputs must be not driven high.

Engine Latency at Powerup

At power up the engine begins executing the code when the power supply level reaches 2.7 V. To complete the boot sequence about 120 ms are required; after this period the engine is ready to start working.

During the VCC stabilization and for Ts ms the interface signals nSCAN_ENABLE, nILLUMINATION_ENABLE and nAIM_ENABLE (if present) should be at low level. The engine allows having high level on the interface during the power up if and only if the input levels are not greater than 3.3 V. If the engine is powered at 5 V and/or the host signals are 5 V this rule is violated. The engine boot time is then Tb ms; after that time the engine is ready to operate.

The DE01 host must respect this timing to properly operate the scan engine:

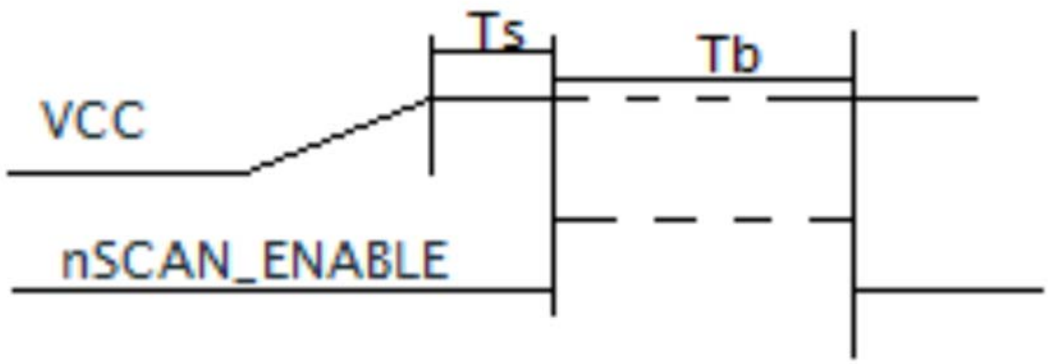


Figure 11. Signals Timing

Item	Description	Value
Ts	Startup Time	5 ms
Tb	Boot Time	120 ms

Table 7. Power-up Timing

USB Powered Host and USB Interface Design Recommendations

The scan engine features some basic ESD protection and a controlled soft start during power up sequence, with a peak surge current below 200 mA (about 40us width) in the first 6ms after providing input voltage. Thus, if the engine is being integrated on a USB powered system, it is recommended to ensure that the host does not exceed the plug-in USB in-rush limits; if so, the host shall provide additional soft start circuitry in order to limit this current peak. This obviously would increase the Ts power up time, of a value depending on the host circuitry design.

Moreover, if USB communication interface is being used, additional standard USB protection for electrical immunity and adaptation shall be applied to USB D+ and D- lines on the Host PCB.

Scan Engine Operation

The Scan Engine features four working modes, that are reachable using the control interface.

Mode	Description
LOW POWER	State for energy saving: the Scan Engine microcontroller is in a state of sleep and most of the internal circuitry is disabled. About 2.5 ms are required for wake up, low power consumption.

IDLE	The scan engine is waiting for commands, all systems ready for starting acquisition. Illumination is turned off, moderate power consumption.
OPERATING	The illumination line is turned on; the scan engine is continuously acquiring/processing images and providing image data or decoded data (depending on model). All systems working, full power consumption.
AIMING	As for "IDLE", plus illumination line is turned on for aiming support. No image processing or decoding; current consumption is about the same of OPERATING mode.

Table 8. Working Modes

The control signals nSCAN_ENABLE, nILLUMINATION_ENABLE and nAIM_ENABLE (the latter in undecoded version only) are constantly monitored and determine the scan engine working mode; the signals can switch with no particular timing or order, even together. Each combination of inputs is associated with a working mode: the scan engine will change modes accordingly, eventually passing to IDLE mode as a transition state.

For optimized operation (where noted) it is always recommended that the host sets actively the engine to IDLE mode as a transition state; in particular:

DE01 decoded models do not have nAIM_ENABLE input, thus the signal is considered as always set High. More in detail:

- For UART model: AIMING mode is still reachable by using a specific command sent by the host via UART interface.
- For USB model: AIMING mode cannot be used, since the host cannot send commands using USB keyboard interface.

Mode transition sequences and mode corresponding inputs are described in the following diagram:

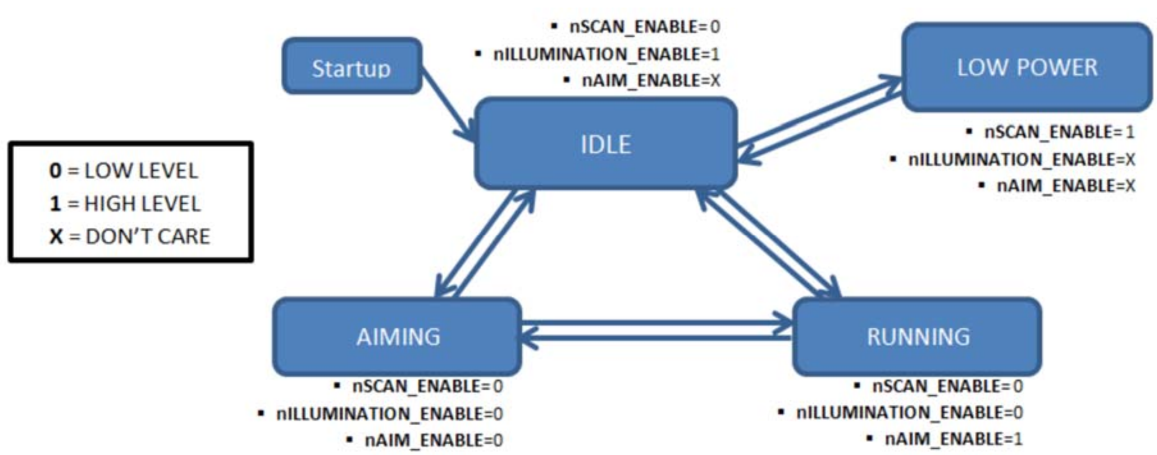


Figure 12. Working Modes Diagram

For instance, if in RUNNING mode the nSCAN_ENABLE is set at high level, the scan engine will go first to IDLE mode then to LOW POWER mode. The timing for all transitions is described in Table 9, where it is also noted when a transition to IDLE is recommended:

		NEW MODE			
		LOW POWER ⇑	IDLE ⇑	OPERATING ⇑	AIMING ⇑
CURRENT MODE:					
LOW POWER	⇒	-	< 2.5 ms	Set to IDLE first	Set to IDLE first
IDLE	⇒	< 3 ms	-	~0.15 ms	~0.15 ms
OPERATING	⇒	Set to IDLE first	< 30 ms	-	Set to IDLE first
AIMING	⇒	Set to IDLE first	~0.15ms	~0.15 ms	-

Table 9. Mode Transition Time

The scanner operation starts by asserting the nSCAN_ENABLE signal to low. This makes the engine exit the LOW POWER state and enter into the IDLE mode, the transition duration is <2.5 ms.

After entering IDLE mode the engine can either parse UART commands, in the case of UART models, or keep polling the interface signals nILLUMINATION_ENABLE and nAIM_ENABLE, in the case of undecoded models. A normal sequence would be to activate nILLUMINATION_ENABLE (assert low) after having activated nSCAN_ENABLE (asserted low) thus starting an acquisition phase. After some acquisitions the host should deactivate the nILLUMINATION_ENABLE (set high) and deactivate the nSCAN_ENABLE (set high) signal to close the acquisition phase and step back to LOW POWER mode. To enter the LOW POWER mode from IDLE the engine takes a time less than 3 ms.

In order to use the aiming system the host should operate both the nILLUMINATION_ENABLE and the nAIM_ENABLE signal: once both signals are low the engine enters AIMING mode. In this state, if a nAIM_ENABLE positive edge transition occurs, the engine goes into OPERATING mode (with the same timing as when in IDLE). If nILLUMINATION_ENABLE goes high the engine goes back to the IDLE state.

In models where signal nAIM_ENABLE is not present, a command toggling AIMING mode sent via the communication interface shall be used.

All models, at IDLE mode, take a time of about 0.15 ms from asserting nILLUMINATION_ENABLE low to turning on illumination and starting to acquire the first image

Decoded models, at IDLE mode, take a time of about 11 ms from asserting nILLUMINATION_ENABLE low to starting to process image data; then decoding time applies depending on the image being acquired. Undecoded models, at IDLE mode, takes a time of about 1 ms from asserting nILLUMINATION_ENABLE low to first SYNC transition. The host should wait at least one SYNC transition before closing the reading phase.

ACTION	TIME after nILLUMINATION_ENABLE negative edge
START IMAGE ACQUISITION and ILLUMINATION ON	0.15 ms
START PROCESSING and DECODING (DECODED MODEL)	< 11 ms
FIRST SYNC TRANSMISSION (UNDECODED MODEL)	< 1 ms

Table 10 Time after nIllumination_Enable

Undecoded Signals

The undecoded model SYNC frequency is about 120 Hz. During the acquisition phase the VIDEO signal transitions low to high and high to low represents the barcode transitions from white to black and from black to white. Every transition of SYNC signal from high to low or from low to high represents the start of a new frame (example: frame1: SYNC=high, frame2: SYNC=low, frame3: SYNC=high, frame4: SYNC=low, etc. …).

The VIDEO signal minimum bar duration is 500 about 340 ns. The minimum possible time between SYNC signal transition and first VIDEO transition is 150 us.

The steady state of VIDEO and SYNC signals is low. During the acquisition phase, if there is nothing to be digitized or the system queues are full, the VIDEO signal can contain no transitions even if the SYNC signal is still running.

The following table details VIDEO and SYNC signal values for each working mode.

ACTION	TIME after nILLUMINATION_ENABLE negative edge
STARTUP	SYNC and VIDEO = floating
IDLE	SYNC and VIDEO = Low
LOW POWER	SYNC and VIDEO = floating
RUNNING	SYNC and VIDEO = switching High/Low
AIMING	SYNC and VIDEO = Low

Table 11 Video and Sync signals undecoded

Appendix A
Technical Specifications

This section lists the technical specification of the DE01 engine family, including reading performance.

Item	Description
Physical Characteristics	
Dimensions	**Nominal size:** Width 0.83"/ 21.0 mm Height 0.45"/ 11.4 mm Depth 0.59"/ 15.2 mm **Maximum size:** Width 0.85"/ 21.6 mm Height 0.46"/ 11.65 mm Depth 0.61"/ 15.5 mm
Weight	9 g / 0.32 ounces
Interface	10 pin ZIF Connector
Electrical Characteristics See Table 8 on page 19 for more information.	
Current	Max. Operating: 300 mA (surge current peak @ startup or exit LOW POWER) OPERATING or AIMING modes (Typical) < 160 mA IDLE mode (Typical) < 35 mA LOW POWER mode < 0.5 mA
Input Voltage	Values at 23°C: VCC: 3.0 – 5.0 VDC (compatible with USB powering)
Performance Characteristics	
Image Sensor	Linear CCD 2500 pixels
Light Source	Illumination: GREEN LED
Field of View	47°

Item	Description
Print Contrast Minimum	15% minimum contrast

Scanning Angles See Definition of Scanning Angles on page 37 for additional information.	
Roll Angle	± 45°
Pitch Angle	± 75°
Skew Angle	± 70°
Minimum Element Width	1D Linear: 2.5 mils

DE01-SR[a]		Typical		Guaranteed	
	Resolution [mils]	Dmin [mm]	Dmax [mm]	Dmin [mm]	Dmax [mm]
Code 39	3	90	190	100	160
Code 39	5	65	340	90	300
Code 128	10	45	550	50	500
EAN	13	40	740	50	640
Code 39	20	(*)[b]	1320	(*)[b]	1200

All labels grade A, ambient light level 300lux, pitch angle 10°, tilt angle 0°, skew angle 0°, room temperature 20°C.

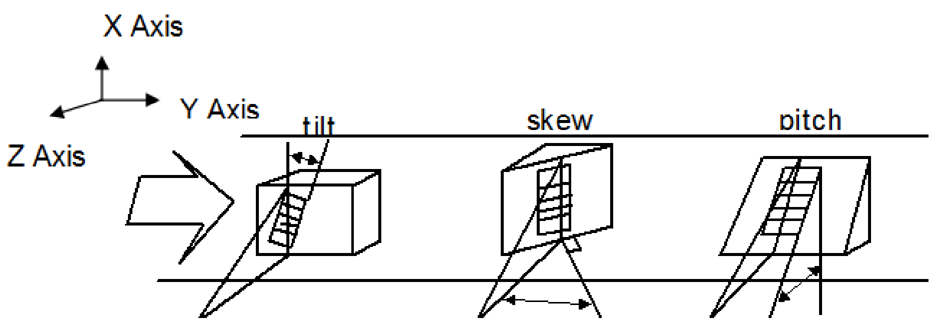
Limited by field of view

Item	Description
User Environment	
Operating Temperature	Operating: -30 to 60ºC / -22 to 140ºF
Storage Temperature	Storage / Transport: -40 to 70ºC / -40 to 158ºF

Humidity (non-condensing)	95%
Mechanical Shock	2000 G ± 5% applied via any mounting surface at – 30° and 70° C for a period of 0.85 ± 0.05 msec 2500 G ± 5% applied via any mounting surface at 23° C for a period of 0.85 ± 0.05 msec
Ambient Light Immunity	Up to 100,000 Lux
ESD Level	±2.0kV @ connector
Regulatory	
Illumination System (GREEN LED)	IEC 62471 Exempt risk group
Environmental	RoHS compliant

Definition of Scanning Angles

Skew, Pitch, Roll Angle testing is based on ISO 15423 specifications



Reading distances are measured along Z-axis.

Figure 14. ISO15423 angle definition

Part Numbers

The DE01 decoded scan engine can be purchased with either USB or UART interface. There are also accessory demo boards which provide USB or UART output. These include an easy way to begin to test the DE01. Accessory UART cable including 5V DC power supply is also available. Part numbers are listed below.

Scan Engines

- DE01-001 DE01 Embedded OEM 1D CCD decoded micro scan module UART interface
- DE01-002 DE01 Embedded OEM 1D CCD decoded micro scan module USB interface
- DE01-003 DE01 Embedded OEM 1D CCD decoded micro scan module undecoded

Accessories

- DE01-ACC-001 DE01 demo accessory test board includes DE01 module and USB interface
- DE01-ACC-002 DE01 demo accessory test board includes DE01 module and RS232 interface
- CAB-DSE-002 Embedded barcode serial power and communications cable RJ45 to DB9 including power jack, power supply, and adapter plug 2M