Honeywell

N36XX Decoded

Image Engine

Integration Manual

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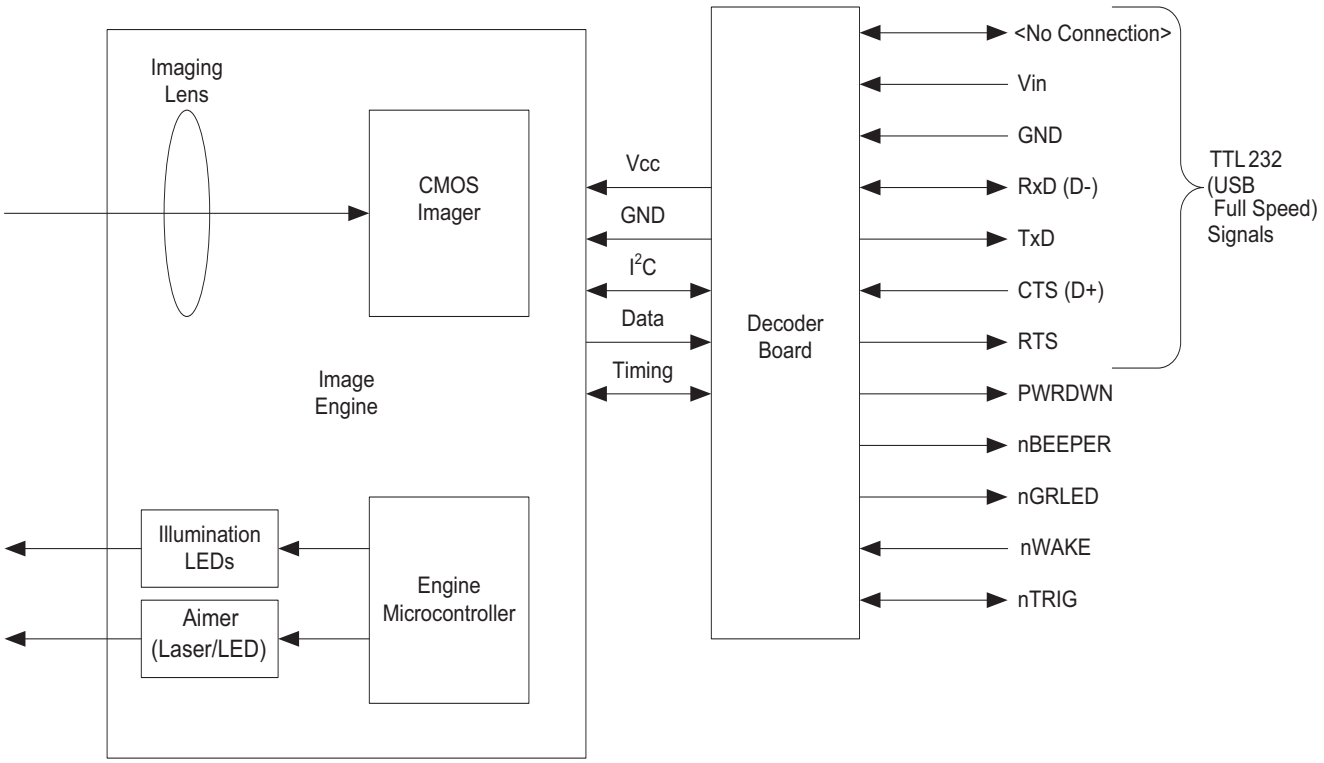
1 Introduction and Installation

About the N36XX Decoded Out Image Engines

The N366XX decoded out engine is a miniature, CMOS imager-based image capture and bar code imaging module device. It is configured to be sold as a bracketed module. The modules are designed for easy integration into an OEM portable device.

The firmware implements an automatic shutter control to provide operation over a wide range of ambient light conditions. The decoder board uses a high-speed microprocessor and memory system to support reading of 1D bar codes, 2D bar codes, and OCR as well as image capture and transfer.

All models are of a modular design consisting of an optics module and a decoder board. The optics module consists of an array sensor, imaging optics, and A/D converter to create a digital representation of the optical signal to be stored in RAM.



The systems may be ordered assembled with a mounting bracket. The following information is presented to assist you in integrating the N36XX module into an OEM application.

12-pinM FPC Connector (Gold)

The product is fitted with a 12-pin FPC connector located on the back of the unit for TTL232 or USB (full speed) communication, optional power, and signaling.

Pin Number	TTL level 232	Input/Output	USB (full speed)	Input/Output
1	<no connection>	-	<no connection>	-
2	Vin	Power	Vin	Power
3	GND	Power	GND	Power
4	RXD	Input	D-	Input/Output
5	TxD	Output	<reserved>	Output
6	CTS[1,2]	Input	D+	Input/Output
7	RTS	Output	<reserved>	Output
8	PWRDWN	Output	PWRDWN	Output
9	nBEEPER	Output	nBEEPER	Output
10	nGoodRead	Output	nGoodRead	Output
11	nWAKE	Input	nWAKE	Input
12	nTrig	Input/Output	nTrig	Input/Output

1. *Signal operation is determined by software configuration.*
2. *For N36XX-XX-XXX (TTL232): 100K ohm pull-up resistor populated in this configuration.*

Host Interface Signal Descriptions

Warning! Do not connect a flex strip to or disconnect a flex strip from the host interface connector when power is present on the flex strip. This could damage the image engine.

TTL Level 232 (12-pin Connector)

Signal	Description
<no connection>	-.
Vin	Power – Supply voltage input. Refer to specified input values on page 3-1.
GND	Power – Supply and signal ground.
RxD	Input – TTL level 232 receive data.
TxD	Output – TTL level 232 transmit data.
CTS[1]	Input – TTL level 232 Clear to Send signal.
RTS	Output – TTL level 232 Request to Send.
PWRDWN	Output – Open drain, 100K pull up on engine; PWRDWN (active high) indication that the N36XX is in power off mode.
nBEEPER	Output – Open drain, 100K pull up on engine; idle high signal that can be an active low DC or PWM controlled AC signal used to drive an external beeper.
nGoodRead	Output – Open drain, 100K pull up on engine; active low signal for driving a low current Good Read LED circuit.
nWAKE	Input – 100K pull up on engine; when in power off mode active low wake up signal to the N36XX.
nTrig	Input, Open drain, weak pull up on engine; Trigger line is an active low signal to trigger the unit. Leave the signal floating for inactive state and connected to ground for active state.

1. For N36XX-XX-XXX (TTL232): 100k ohm pull-up resistor populated in this configuration.

USB Interface

The N36XX supports the following USB Low-Speed client interfaces:

Keyboard

The bar code data is sent as it would be typed. The scanner can be configured to send certain keystrokes before and after the bar code. Typical speed is 10-15ms per character. This interface cannot be used to transfer images to the host.

COM Port Emulation

The COM port emulation performs as if the scanner was connected to a typical COM port. A custom driver is provided by Honeywell.

HIDPOS

The N36XX conforms to the USB Bar Code Reader Interface definition.

IBM SurePOS

This interface is used if you want to connect via USB with IBM SurePOS capabilities. (This is the best choice when connecting to the USB port of an IBM POS terminal).

Note: For additional USB programming and technical information, refer to Honeywell's "USB Application Note," available at www.honeywellaidc.com.

Trigger Modes

The N36XX supports four basic trigger modes: Manual/Serial, Low Power Manual Trigger, and Presentation Mode. See the User's Guide for additional trigger mode information.

Manual/Serial Trigger

Manual and serial trigger modes are used to initiate a scanning session. The N36XX waits in a reduced power state for a trigger indication in the form of a command from the TTL Serial or USB interface, or an active low signal from the nTRIG pin of the host interface connector.

The serial command strings that activate and deactivate the trigger function are:

Serial Trigger

Activate:	[SYN]T[CR] or [SYN]t[CR]
Deactivate:	[SYN]U[CR] or [SYN]u[CR]
	where [SYN] = 0x16 and [CR] = 0x0d

Low Power Manual Trigger (Power Off Mode)

Note: This selection is only valid in the TTL-232 Configuration.

Lower power trigger mode causes the N36XX to power off between scans. A manual trigger activation causes the power to be turned on. The trigger line is controlled on the N36XX with a pullup so the line must be left floating to successfully enter the low power modes. The Aim/nWake line must be idle high at the time of power down, otherwise the unit will not go into stop mode. The scanner scans until a timeout or a decode, indicating the appropriate status (beeper and good read LED), outputs the data, and, if the trigger has been released, turns off the power. See Thermal Considerations on page 2-1.

Presentation Mode

Presentation Mode uses ambient light to detect bar codes. The LEDs are dimmed for ambient conditions until a change occurs in the imager's field of view. Then the LEDs become brighter automatically to read the code. If the light level in the room is not high enough, Presentation Mode may not work properly. See Thermal Considerations on page 2-1.

Status Indicators

Good Read LED (Pin 10)

The N36XX provides a pin on the host interface connector (nGRLED) that can be used to drive an LED to indicate a Good Read status. This signal is driven by an Open Drain NC7WZ07 device with a V_{Omax} = 5.5V through the 100K pull up resistor on the engine. It is capable of sinking 32mA at Vin = 4.5V (N36XX supply voltage) or 24mA at Vin = 3.3V.

Beeper (Pin 9)

The N36XX provides a pin on the host interface connector (nBEEPER) that provides a PWM output for generating audible feedback to the user. This signal is used to indicate the status of the device using a variety of patterns and frequencies.

This signal is driven by an Open Drain NC7WZ07 device with a V_{Omax} = 5.5V through the 100K pull up resistor on the engine. It is capable of sinking 32mA at Vin = 4.5V (N36XX supply voltage) or 24mA at Vin = 3.3V.

Power Down (Pin 8)

The N36XX provides a pin on the host interface connector (PWRDWN) that provides an indication when the device is powered down (active high).

When configured for PWRDWN (GPIOFO0), the signal is designed to be used as an indication to the host that the engine is currently powered down. The ability to power down the unit is limited to TTL232 Low Power Mode (TERMID0;TRGMOD2).

This signal is driven by an Open Drain NC7WZ07 device with a V_{Omax} = 5.5V through the 100K pull up resistor on the engine. It is capable of sinking 32mA at Vin = 4.5V (N36XX supply voltage) or 24mA at Vin = 3.3V. It is not advised nor conceivable to allow this signal to act as the drive source for external illumination.

2 Power Control

Illumination/Aimer Control

The image engine illumination and aimer are controlled directly by the device. Management of these features, other than enabling or disabling them, is not exposed to the end user.

Thermal Considerations

⚠ ***When selecting any continuous trigger mode, the ambient temperature should not exceed the maximum operating temperature of the device. If the temperature exceeds the maximum operating temperature, the performance of the device may be reduced, the life of the product may be shortened, and permanent damage may occur to the device.***

Care must be taken when designing the image engines into high ambient temperature applications where high duty cycle or auto-trigger scanning is required. Such conditions can induce self heating of the image engine that can increase image noise. This can result in degraded bar code reading performance and a reduction in image quality. The following precautions should be taken when integrating the image engine.

- Turn off the aiming and illumination LEDs whenever possible.
- Applications where the illumination is not needed use the menu command SCNLED0. application where the aimer is not needed use the menu command SCNAIM0.
- When auto-trigger operation is required, use presentation mode since this mode has “built-in” thermal management features.
- Set the SDRTIM menu command to allow the processor to enter its power saving mode quickly after a bar code decode. (See the SDRTIM description below.)
- Provide air flow to the image engine, when possible.
- Allow ambient light to assist the image engine in bar code decoding, thereby reducing the on-time of the illumination LEDs.

Honeywell engineers have successfully designed the image engine into many applications as described above. Please contact your Honeywell sales manager or solutions architect for detailed design assistance.

SDRTIMxxx Menu Settings

The menu setting SDRTIMxxx can be used to improve the trigger to decode time of the N36XX image engine in certain use cases. However, in other use cases, the performance of the imager can be degraded substantially if this parameter is incorrectly set. This section defines the SDRTIMxxx setting and discusses when it should be changed from its default configuration.

Definition of SDRTIMxxx

SDRTIM is an abbreviation for "Scan Driver Timeout". The setting is used to configure the length of time that the imager is allowed to keep running after it is untriggered (either by a removal of the trigger signal, or by the successful decoding of a bar code). The parameter xxx is the time, in milliseconds, that the imager continues to run. For example, if the parameter SDRTIM200 is sent to the image engine, the imager continues to gather images with the illumination LEDs off, and the decoder board will continue to store those images into memory for 200 ms after the imager is untriggered. When the SDRTIM setting expires, the image engine transitions to standby mode to conserve power until it is triggered once again.

Negative Ramifications of Long SDRTIM Settings

Caution must be used when setting SDRTIM to a very long time period. Since the image engine never enters the power saving standby mode, significant internal heating of the image engine can occur. In high ambient temperature situations, this can result in elevated N36XX internal temperatures that can cause signal to noise degradation of the images. Consequently, the images from the image engine can be unacceptable for human viewing, and bar code reading may no longer be possible. Additionally, since the imager never enters standby mode, the battery life of battery operated systems will be reduced.

Recommendations

It is not advisable to change the SDRTIM command from its default configuration, which is 1 ms (SDRTIM1). Please do not change this setting from its default conditions without consulting a Honeywell Solutions Architect.

3 Electrical

DC Characteristics

Operating Voltage

Configuration	Configuration	Min	Nominal	Max	Unit
TTL232 Only[1]	N36XXX-XXX-XX	3.14	3.3	3.47	V
USB (Full Speed) Only[2.3]	N36XXX-XXX-XX	4.75	5.0	5.25	V

1. *At least 3.14V must be maintained at the N36XX input connector during scanning.*
2. *At least 4.75V must be maintained at the N36XX input connector during scanning.*
3. *No TTL232 option available.*

Warning! Do not connect a flex strip to or disconnect a flex strip from the host interface connector when power is present on the flex strip. This could damage the image engine.

Absolute Maximum Ratings (T=23°C)

Parameter	Min	Typ	Max	Unit
V_{Input}	-0.5		5.5 (USB) 3.6 (TTL232)	V
V_{Output}	-0.5		Vcc +0.5	V

DC Operating

(Vcc +3.3V, T= 23◦ C)

Parameter	Signals	Min	Typ	Max	Unit
V_{IL}	nRXD, nCTS			0.84	V
V_{IH}		2.31			V
V_{IL}	nWAKE			0.84	V
V_{IH}		2.31			V
V_{OL}	PWRDWN, nBEEPER, nGRLED			0.55	V
V_{OH}		100K to VCC			V
V_{OL}	nTXD, nRTS (I_O = 16mA)			0.55	V
V_{OH}		2.31			V

(Vcc +5V, T= 23◦ C)

Parameter	Signals	Min	Typ	Max	Unit
V_{IL}	nWAKE			1.0	V
V_{IH}		3.35			V
V_{OL}	PWRDWN, nBEEPER, nGRLED			0.55	V
V_{OH}		100K to VCC			V

1. *For N36XXX-XXX-XX (USB Full-Speed): No additional pull-ups are populated in this configuration. For N36XXX-XXX-XX (TTL232): Termination of these signals are required in this configuration. Need to terminate Pin 6 (CTS) if flow control is not used.*

Current Draw

For TTL232: Idle, Standby and Power Off power modes are controlled by the SDRTIM, 232LPT, TRGLPT, and TRGMOD settings. Idle mode is entered when the SDRTIM time-out expires. Standby mode is entered when the SDRTIM and 232LPT time-outs expire. Power Off mode is entered when the SDRTIM, 232LPT and TRGLPT time-outs expire. Use TRGMOD2 to enable Power Off mode.

For USB: Standby mode is entered when USB suspends.

(T_A= 23◦ C)

Power Mode	Description	3.3V (RS232 w/ Interface Board)	5V (USB) No interface board connected
I_{Peak} *1,2*	Peak current draw when the engine is scanning (Manual Trigger)	345mA	245mA
$I_{OperatingAverage}$ *1,2*	Average current draw when the engine is scanning (Manual Trigger)	310mA	220mA
I_{Idle} (imager powered on) *1,2*	Typical current draw while not scanning or decoding, but power is applied to the imager. Controlled by the menu commands SDRTIM and IMGPWR.	110mA	78mA
I_{Idle} (imager powered off) *1,2*	Typical current draw while power is not applied to the imager. Controlled by the menu command IMGPWR.	65mA	60mA
$I_{Standby}$ *1,2*	Typical current draw while in standby mode. For RS232, Standby mode is entered when the menu command 232LPT expires while in Idle mode. (This mode is only available in a 232 configuration). For USB, Standby mode is entered when USB suspends.	3.5mA	2.5mA
$I_{Power\ Off}$ *1,2*	Current draw while in Power Off mode (PWRDWN signal is high). Mode is entered when the menu command TRGLPT expires while in both Standby and Manual Low Power (TRGMOD2) modes. (This mode is only available in a 232 configuration).	.03mA	n/a

1. Average Value
2. Modified interface board with beeper/LED removed used for this measurement, also disconnect 232 cable while measuring

Power Conditioning and Interruptions

Always apply power to the imager *after* connecting to the interface device.

Warning! Connecting the imager to live power ("hot plugging") may damage the electronic components of the imager.

A clean and stable power source is required for the imager. Momentary power interruptions or fluctuations put the imager into Power Off mode.

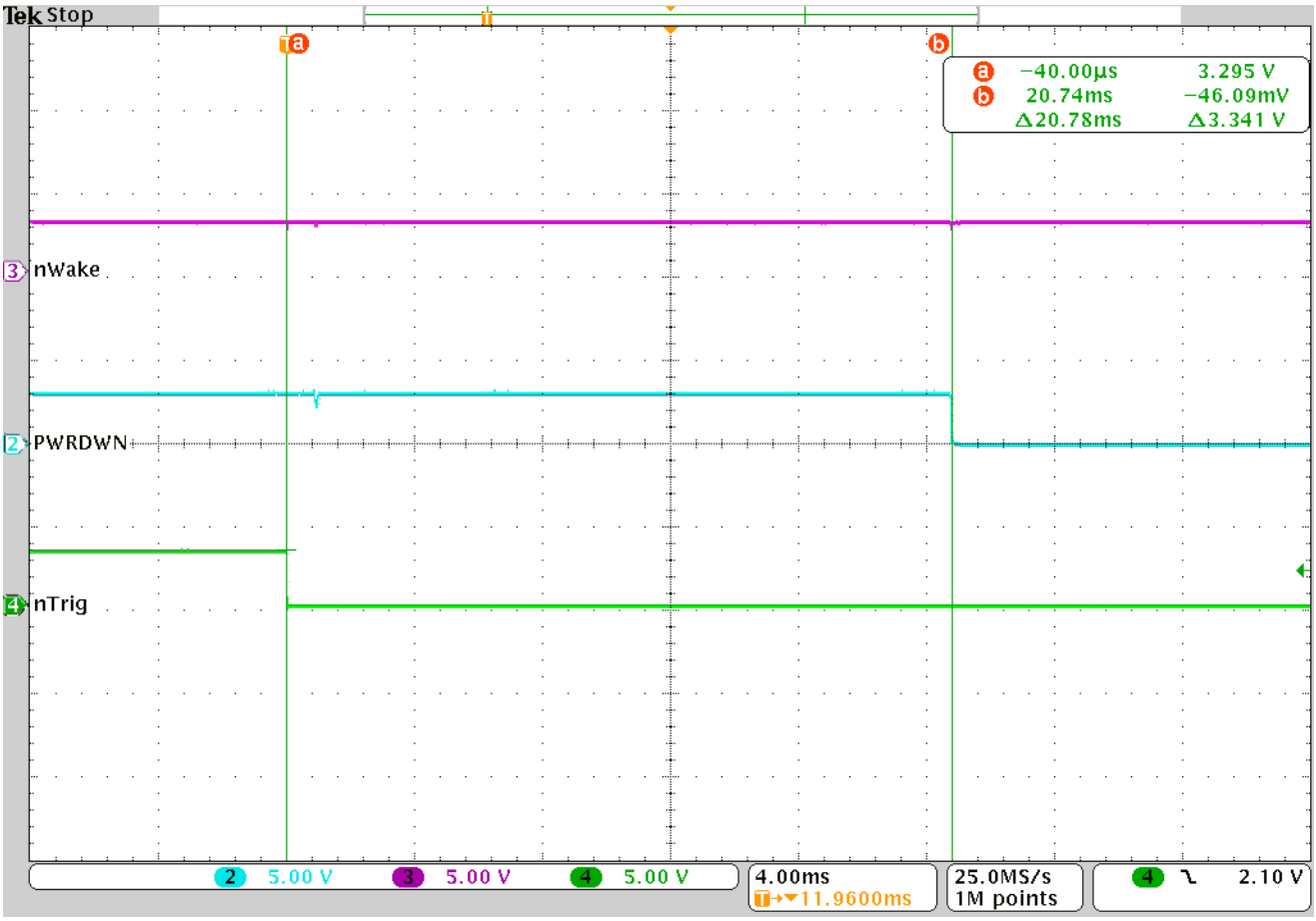
AC Characteristics

The following diagrams indicate the typical timing for the Power-up and Power-off.

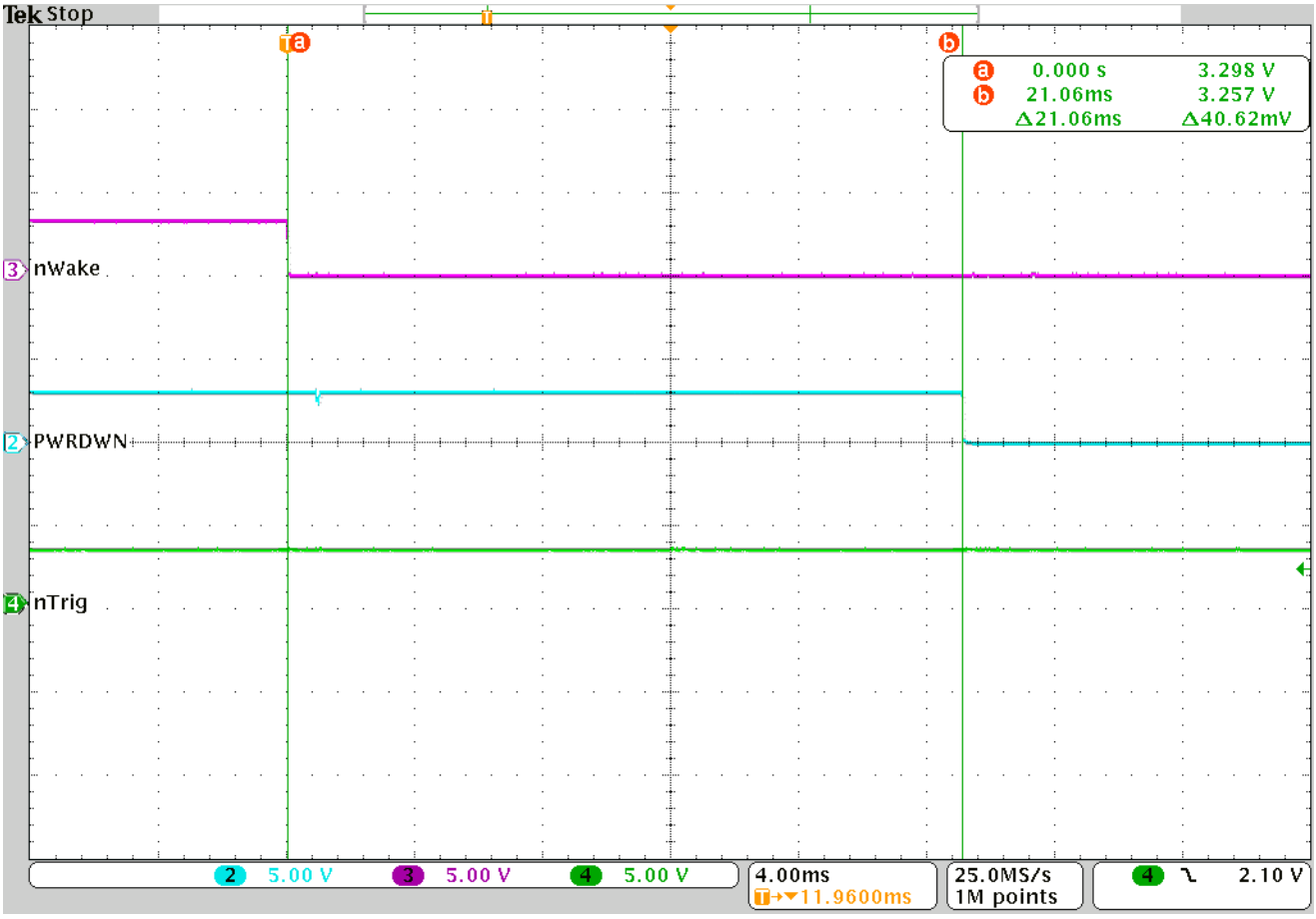
*Power Up From Power Off State (Low Power Mode)**

The PWRDWN signal goes low ~21ms after the wake up event occurs, indicating that the device is powered up and ready to start scanning.

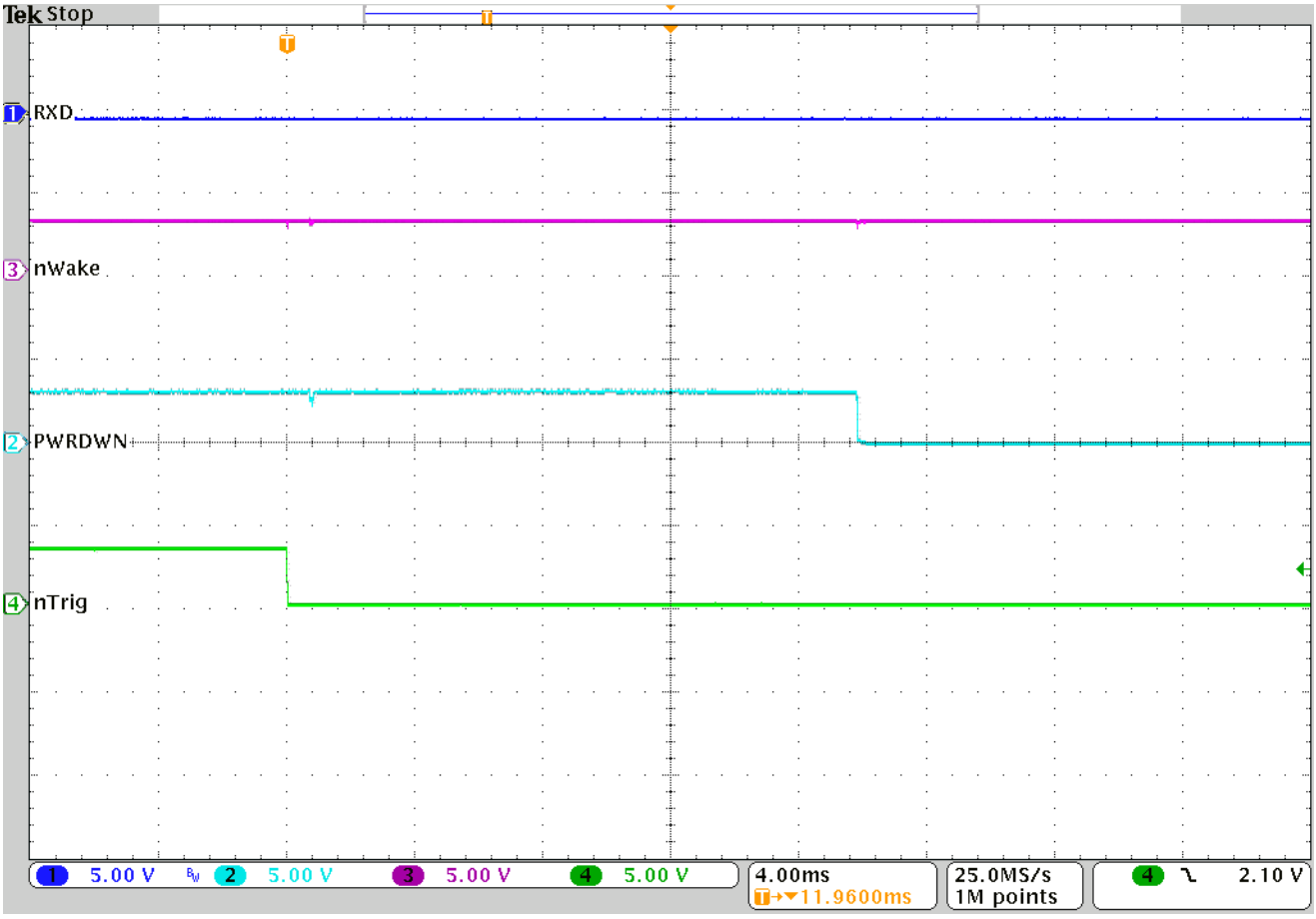
nTrig - Activating the trigger*



nWake - Toggling nWake*



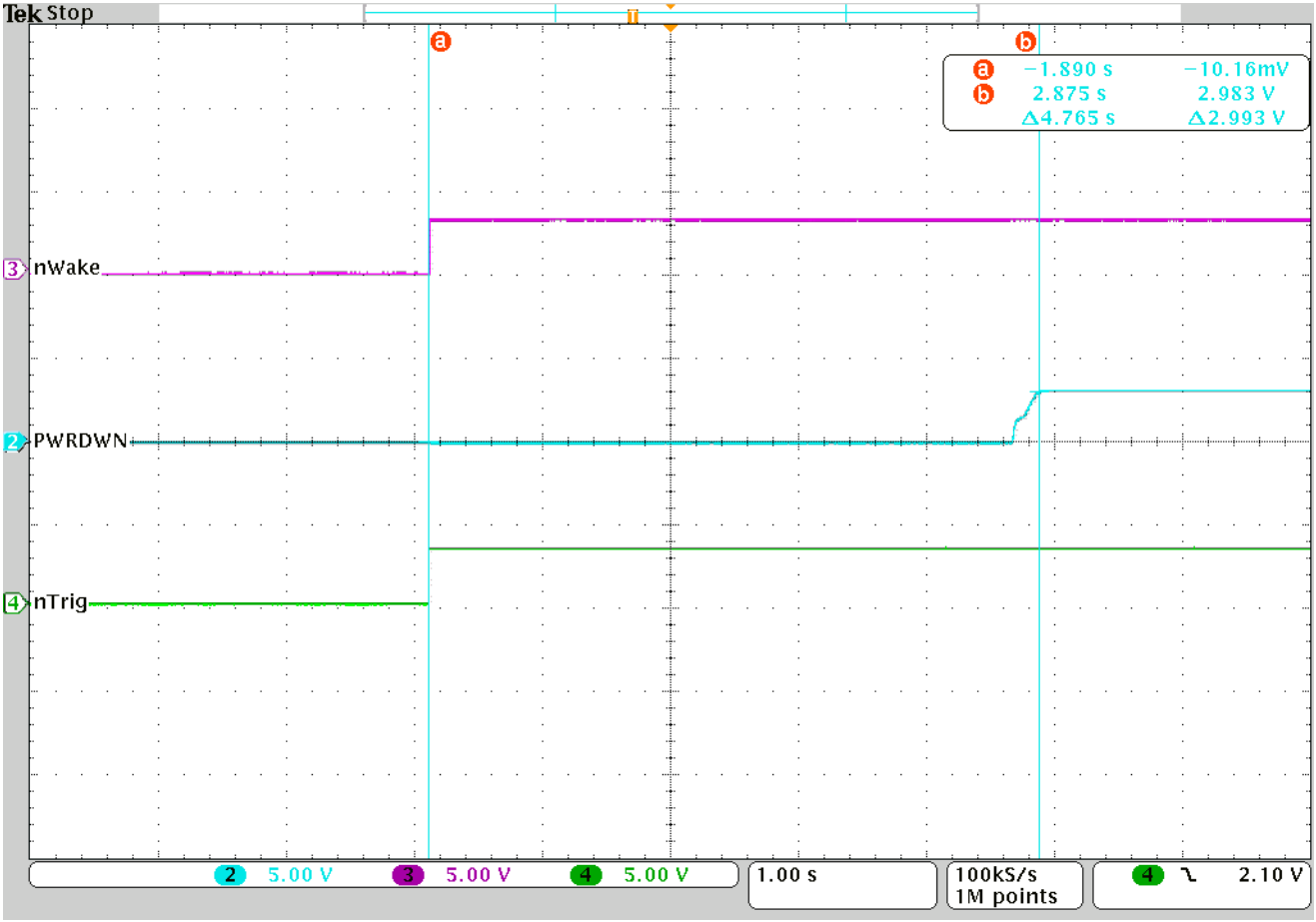
Tx - Sending data from the host*



*Note: * The following settings were used to capture the above plots: DEFALT;TERMID0;TRGLPT2;232LPT2;TRGMOD2.*

*Power Off Timing (Low Power Mode)**

After nWAKE and nTRIG are released it takes about 5 seconds for the PWRDWN signal to go high (hardware time-out) with the lowest setting for TRGLPT (TRGLPT1 - low power time-out of 1 second). Below is a representation of the power off sequence.

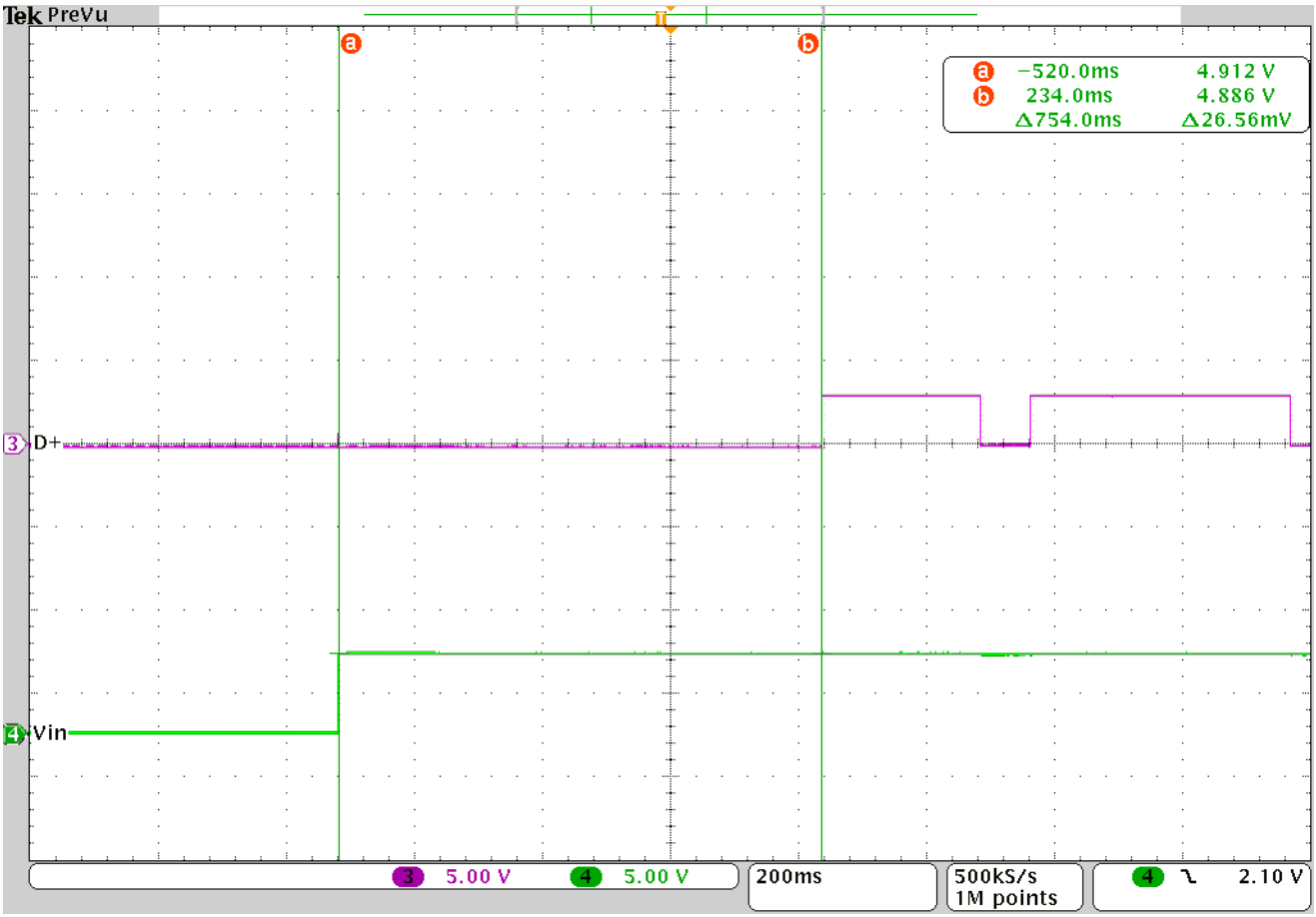


* The following settings were used to capture the above plots: DEFALT;TERMID0;TRGLPT1;TRG-MOD2.

USB Enumeration Timing

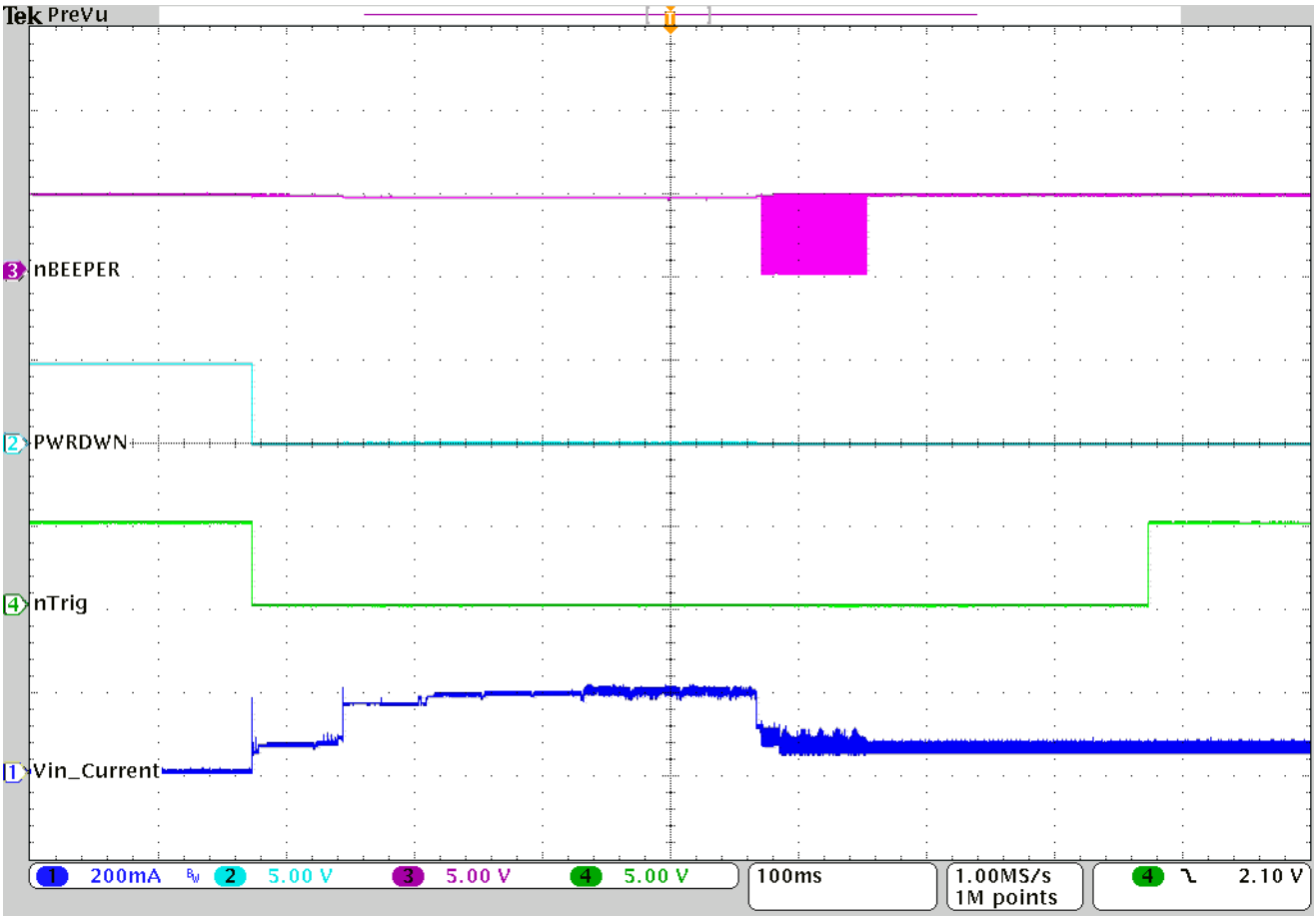
USBSPD0 -- Full Speed

Showing Vin, nRESET and D+.



Interleaved Mode

Typical current profile from power up to power off - showing Vin current, nTRIG, nGOODREAD, PWRDWN.



Environmental Specifications

Parameter	Specification
Temperature Ranges (non-condensing):	
Operating	14° F to 104° F (-10° C to 40° C)
Storage	-40° F to 140° F (-40° C to 60° C)
Humidity (Operating and Storage)	Up to 95% RH, non-condensing at 104° F (40° C)
Shock	The engine function properly after being subjected to 18 shocks of 2,500 Gs for 0.4 msec at 73.4° F (23° C) applied via the mounting surface.
Vibration	The engine will function properly after the following vibration test. The imaging module will be vibrated with a displacement of 1" (25.4mm) p-p from 5Hz to 13Hz and with an acceleration of 10G's peak from 13Hz to 500Hz, 1 G acceleration (500 Hz to 2,000 Hz). The frequency sweep will be linear in one direction and will be 15 minutes in duration. The test will continue for one hour along each of three perpendicular axes.
MTBF	The engines have a calculated MTBF of greater than 70,000 hours based upon MIL-HDBK-217F (release December 1, 1991). The calculation is based on the part count method for the Ground Benign (GB) environmental conditions.

4 Optics and Illumination

Sensor

CMOS sensor with rolling shutter and 640 x 480 pixel resolution; 30 frames per second.

Illumination Wavelength

White LED with CCT 5000K

Aiming Wavelength

640nm visible Hyper Red LED.

Window Placement

Distance from Window

The window should be mounted as close as possible to the front of the Image Engine (parallel, no tilt). The distance measured from the front of the engine to the closest surface of the window should not exceed 0.8mm. Since unwanted reflections can occur at either surface and the window thickness can vary, the distance from the front of the imager light gasket to the far side of the glass should not exceed 2.4mm. For windows thicker than 1.5mm, the distance should be decreased so that the far side of the window does not exceed 2.4mm from the front surface of the engine. If the glass thickness is increased from 1.5mm to 2mm, the distance from the front of the engine to the near surface of the window needs to be decreased by 0.4mm to maintain the maximum distance of 2.4mm from the front of the engine to the far side of the window.

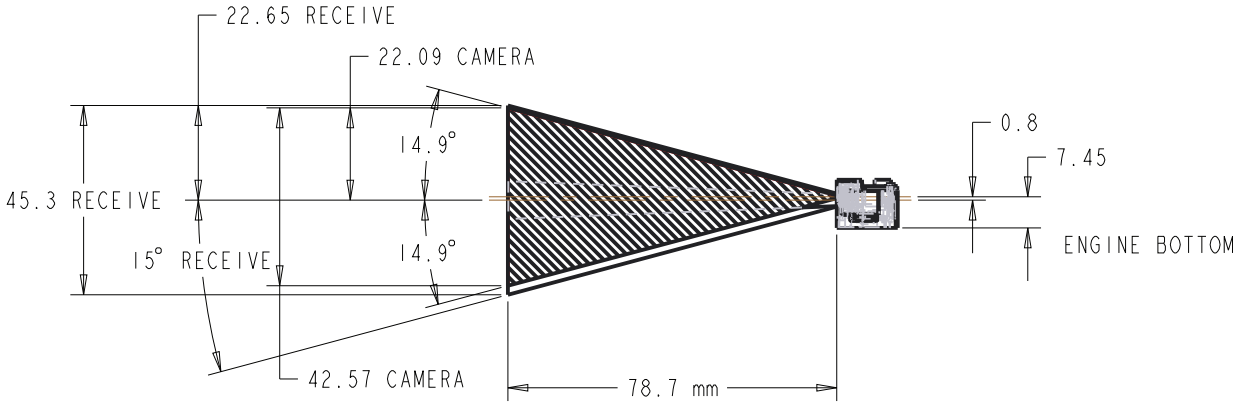
Reflective Materials in the Imager's Field of View

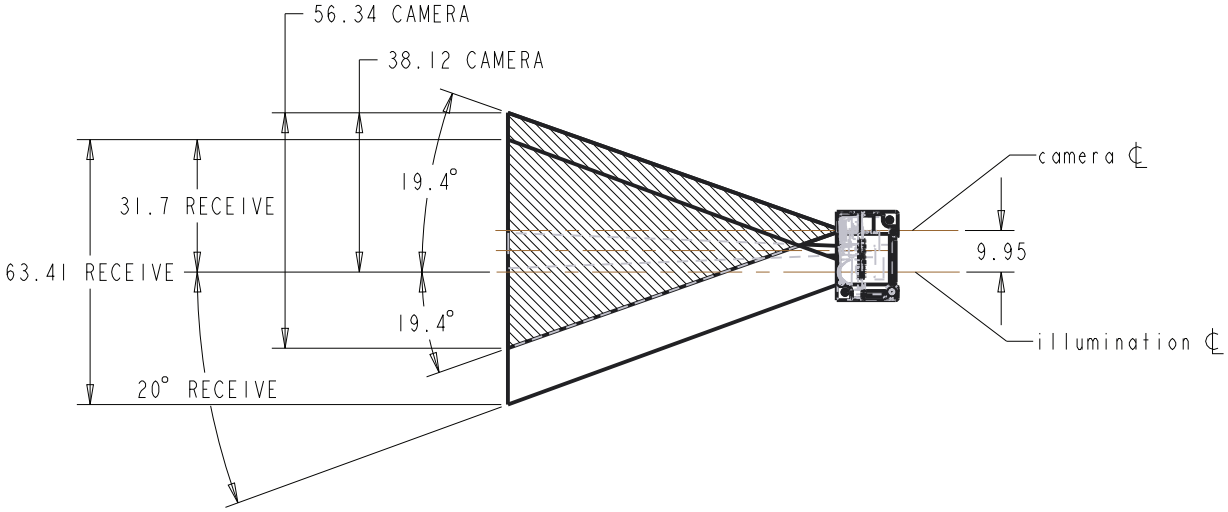
Highly reflective objects in the imager's field of view can cause bright spots to appear in the image and can increase the amount of time needed to read the image. These bright spots are analogous to the reflections seen when taking a snapshot of a mirror with a flash camera. When designing the imager into fixed mount applications, keep highly reflective machine components out of the imager's field of view. If such components must be within the imager's field of view, blacken or shield them to prevent this problem from occurring.

Window Size and Material Requirements

1. Window material must be clear. Clarex (cast acrylic) is preferred. Polycarbonate and CR39 are also acceptable. The window material should have a hard coating over it to protect it from scratches.
2. A minimum thickness of .03 inches (.762 mm) is recommended for this window, with a maximum allowable thickness of .062 inches (1.57mm). These dimensions prevent reflections from the window that can be seen by the camera.
3. Window clear aperture shown in the following Window Size Diagram is for the location shown. The window size must increase as it is moved away from the optics module to accommodate the aiming and illumination envelopes shown.

Window Size Diagram





Bar Code Presentation Angle

Bar codes printed on glossy or laminated paper are best read at angles greater than 5° in relation to the Image Engine. This prevents bright illumination reflections from being returned to the Image Engine.

Depth of Field–Guaranteed Specifications

The guaranteed depth of field measurements used the following parameters:

- Distances are measured from the front of the engine.
- +23°C (+73°F), 0 lux
- Photographic quality codes

Symbology	Near Distance (mm)	Far Distance (mm)	Depth of Field (mm)
5 mil Code 39	75	120	45
13 mil UPC (100% UPC)	59	225	166

Depth of Field–Typical Specifications

The guaranteed depth of field measurements used the following parameters:

- Distances are measured from the front of the engine.
- +23°C (+73°F), 535 lux
- Photographic quality codes

Symbology	Near Distance (mm)	Far Distance (mm)	Depth of Field (mm)
5 mil Code 39	61	130	69
20 mil Code 39	60	380	320
13 mil UPC (100% UPC)	55	280	225
6.7 mil PDF417	60	125	65
10 mil Data Matrix	60	130	70
20 mil QR	50	230	180

Field of View/Resolution

Focus	N3680
Horizontal Field Angle (degrees)	±18.9
Vertical Field Angle (degrees)	±14.4

Note: DPI can be calculated based on the following formula:
Horizontal DPI = 640 pixels/width of horizontal field of view (inches)
Vertical DPI = 480 pixels/width of vertical field of view (inches)

Bar Code Reading Angles

Note: The following angles are not cumulative.

Specular Reflection Angle: ±5°

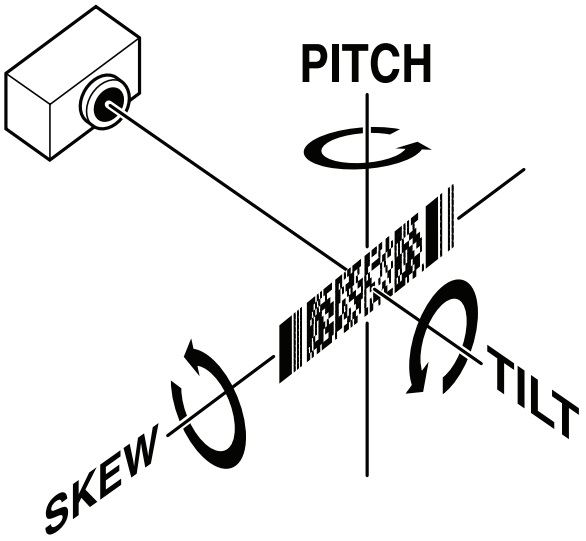
Pitch: ±45 degrees typical for 13 mil UPC, ±45 degrees typical for 20 mil Data Matrix

Skew: ±65 degrees typical for 13 mil UPC, ±45 degrees typical for 20 mil Data Matrix

Tilt: 360°

1D code also depends on length of code - up to 360°

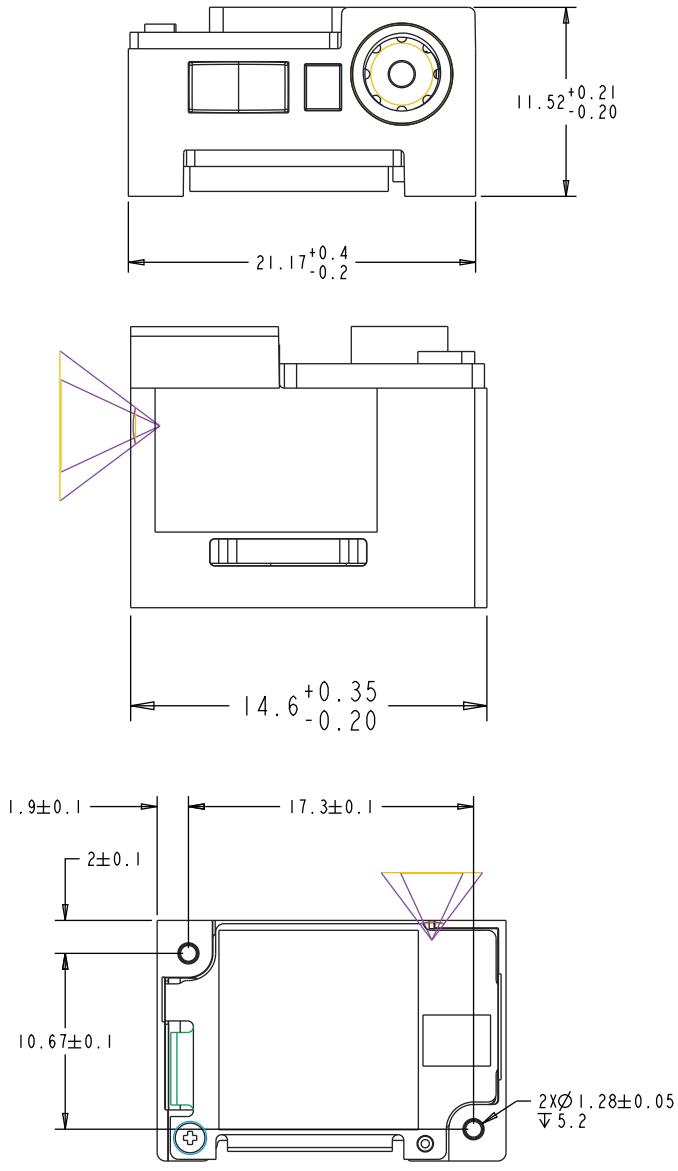
2D code 360°



5 Mechanical Specifications

N36XX Engine Bracketed Mounting

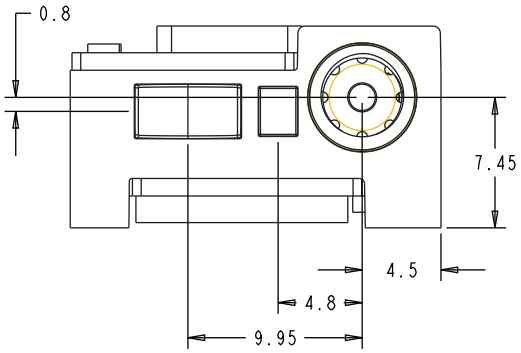
The illustrations below show the mechanical mounting dimensions for the N36XX:



Units = mm

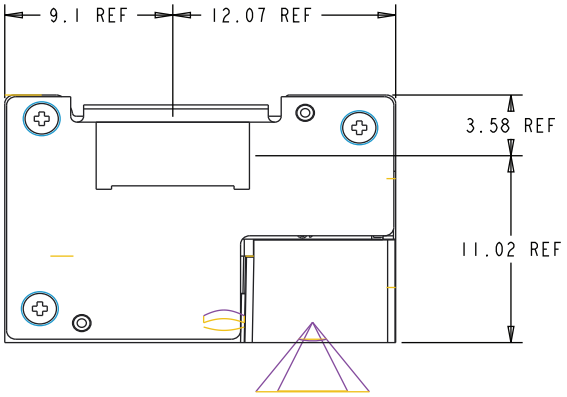
Note: 2 piece #1.6 self tapping screws are used to mount the engine. The recommended torque is 1.25(+/-0.1)Kgf.cm. The screw length is decided by the integrator's configuration and the recommended lock depth is 4(+/-0.5)mm. Any screw should be tested to verify proper fit and performance with the module.

The illustration below shows the lens center dimensions for the N36XX:



Units = mm

N36XX Connector Position



Units = mm

Board-to-board connector is used to connector the camera module on the illumination board. The illumination board is fixed on chassis with a clip feature and UV glue. Mounting the engine will not cause the camera module's to move.

Optics Module Interface Connector

A 0.4mm board-to-board Panasonic connector (header) AXK820145 is used on BYD camera module, and to mate the socket AXK720147G on the illumination board. See Panasonic catalog for details.

Host Interface Connector

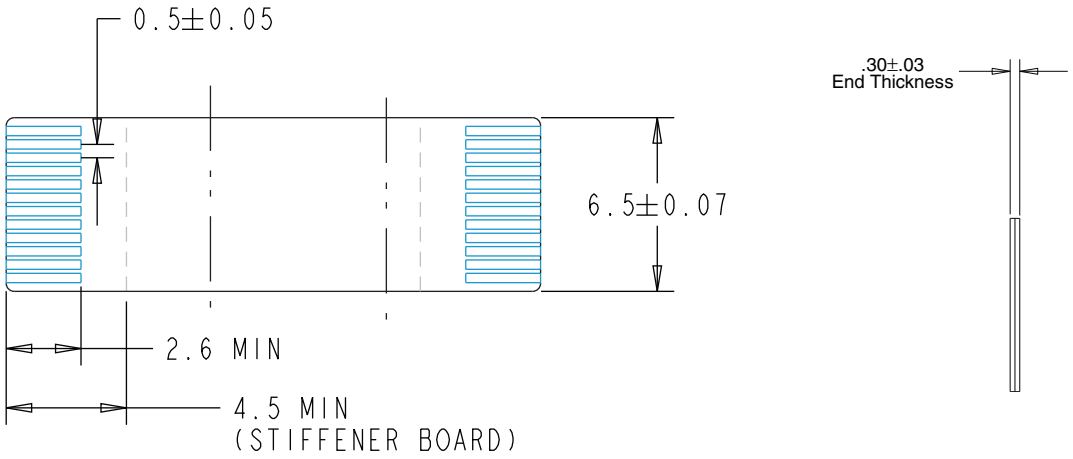
The host interface connector is a Molex 51281-1230, 12 pin, 0.5mm pitch, non-ZIF horizontal surface mount FPC connector. See Molex catalog for details.

The N3680 uses a flex-rigid board, which includes an illumination board, a decode board and an interface board. The flex board connects the illumination board and the decode board. No connector is needed.

The N3680 uses a flex-rigid board, which includes an illumination board, a decode board and an interface board. A board-to-board connector is used to connect the optics module onto the illumination board. No flex circuit is needed.

Host Flex Circuit/Strip

The host interface flex should be compatible with a 50109124-001 (gold plated, lead free) style connector. The following is an example of a flex circuit:



Units = mm

Recommended characteristics:

Trace Width .35 mm
Consult the connector manufacturer for the required thickness of the flex and flex cable recommended dimension.

Also see Design Considerations / Test Results on page A-1.

6 Product Agency Compliance

Product Agency Compliance

Note: It is the OEM manufacturer's responsibility to comply with applicable regulation(s) in regard to standards for specific equipment combinations.

ESD Precautions

The engine is shipped in ESD safe packaging. Use care when handling the scan engine outside its packaging. Be sure grounding wrist straps and properly grounded work areas are used.

Dust and Dirt

The engine must be sufficiently enclosed to prevent dust particles from gathering on the imager and lens. When stocking the unit, keep it in its protective packaging. Dust and other external contaminants will eventually degrade unit performance.

RoHS

The engine is in compliance with Directive 2011/65/EU, Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS), dated January, 2003.

A Design Considerations / Test Results

EMI Considerations

Electro-magnetic interference is a concern in all electronic designs. The effects of EMI are enhanced as designs become more digital and the digital circuits' speed increases. The N36XX is no exception.

The N36XX does not preclude end product integrations from obtaining regulatory and safety standards. The OEM integrator will need to verify compliance as implemented in their host system.

The Main Board

The Main board is based on a 24KHz crystal in the decoder board section that is used to generate a 400MHz clock for the core and a 133MHz clock for the memory interface. There are a number of other frequencies that may be generated at any given time depending on what interface the decoder board is set up to use or various intermittent signatures that occur in a typical image capture and decode process. There are three switching power supplies on the decoder boards that operate between 1MHz and 2MHz.

The Imager

The imager runs based on a 24MHz pixel clock frequency.

Design Considerations

There are several considerations that must be made when designing a system to utilize the N36XX. When integrating the N36XX to other components in the system, ensure that a clean power supply is being used and that there is good signal ground integrity (the quieter the better). The other major consideration in any system is interconnects. The N36XX uses flex circuits for its interconnect to the host system and between the decoder board and image engine. Proper flex strip design is critical to achieving adequate EMI results. The length, impedance, shape, and routing path of the flex can play big roles in the EMI signature of a product. A short list of considerations when designing with flexes follows:

Test Results

The N36XX is designed to meet EN55022 B emission levels. The N36XX has been tested for compliance using representative models.

Model 1 (page A-2) is based on a cabled platform (RS232):

- The N36XX is mounted on the Honeywell demo board.
- The demo board is connected to the host via an 8 foot long, coiled, TTL level 232 cable (CBL-020-300-C00).
- The N36XX is operating in TTL serial-232 mode.

Model 2 (page A-5) is an alternate cabled platform (USB Full Speed):

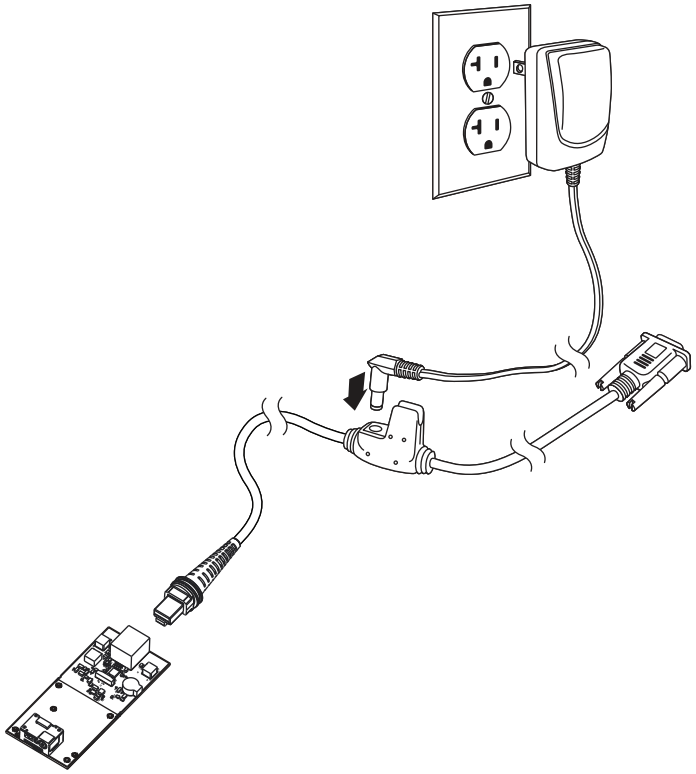
- The N36XX is mounted on the Honeywell demo board
- The demo board is connected to the host via a Honeywell 8 foot long, straight, USB cable (CBL-500-300-S00).
- The N36XX is operating in USB mode (USBSPD0).

The following pages document the test results.

Note: The charts show the quasi-peak values, which are used to determine pass/fail, while the graphs show maximum hold values.

Model 1: N36XX TTL232 Unit

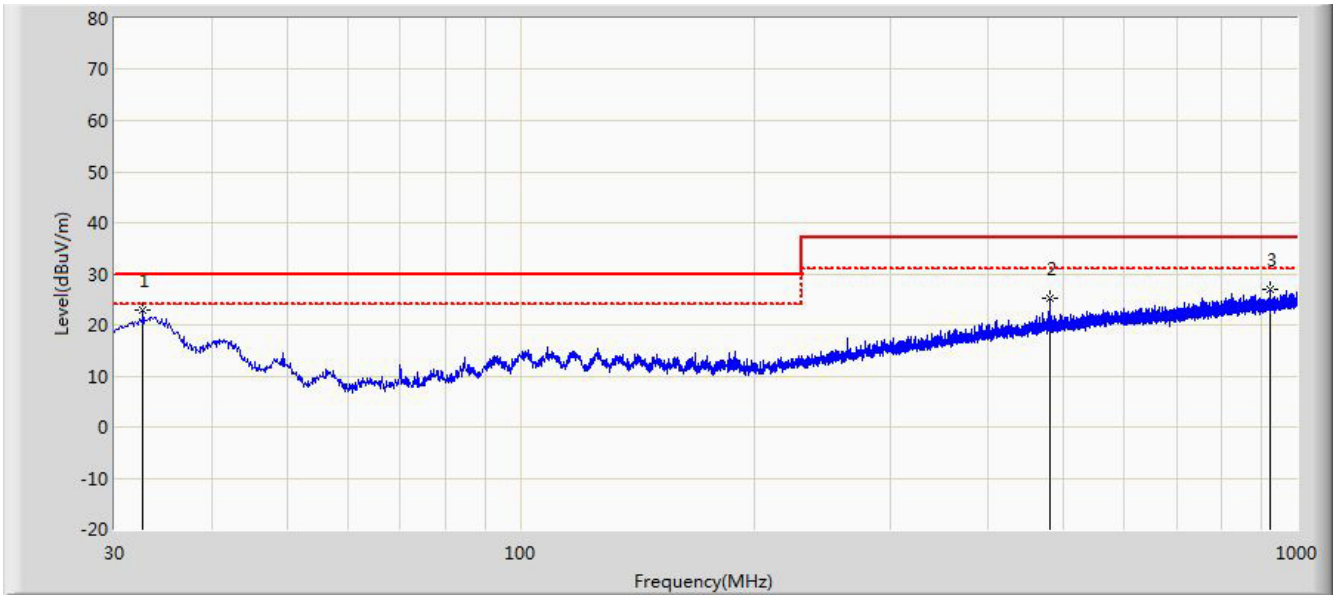
The illustration below shows a unit similar to the unit tested:



This system passed FCC class B limits at all tested frequencies. The test results are shown in the following charts.

Model 1 - Radiated Emissions Measurements 30-1000 MHz (Horizontal)

Limit	EN55022_RE(10m)_Class B
Probe	CBL6112B_2931 (30-1000MHz)
EUT	N36XX TTL232
Margin	6
Polarity	Horizontal
Power	AC 230V/50Hz



No	Mark	Frequency MHz)	Measure Level	Reading Level	Over Limit	Limit (dBuV/m)	Probe (dB/m)	Cable (dB)	Amp (dB)	Ant (POS (cm)	Table Pos (deg)	Type
1	*	32.667	22.801	27.615	-7.199	30.000	16.426	1.003	22.243	0	0	PK
2		479.959	25.328	25.487	-11.672	37.000	16.944	4.607	21.711	0	0	PK
3		924.825	26.814	20.035	-10.186	37.000	20.813	6.909	20.943	0	0	PK

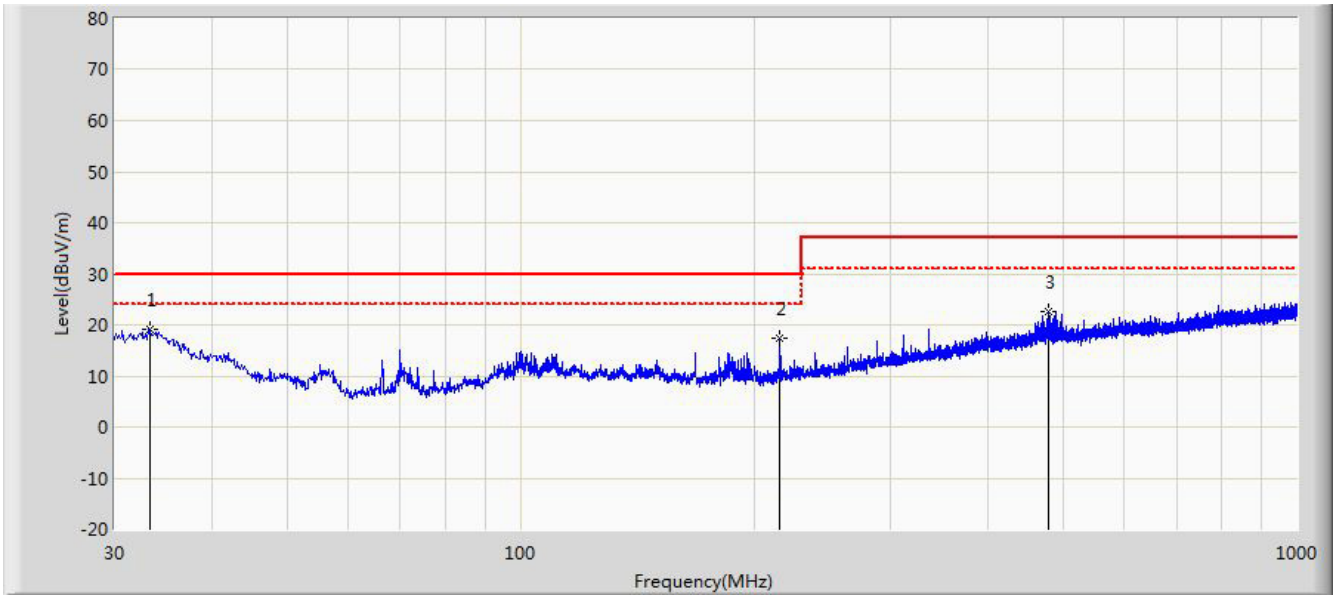
Note: All readings below 1GHz are quasi-peak. Readings below 1GHz are performed with peak and/or average measurements as necessary.

Note: "" means this data is the worst emission level.*

Note: Measurement Level = Reading Level + Factor (Probe+Cable+Amp).

Model 1 - Radiated Emissions Measurements 30-1000 MHz (Vertical)

Limit	EN55022_RE(10m)_Class B
Probe	CBL6112B_2933 (30-1000MHz)
EUT	N36XX TTL232
Margin	6
Polarity	Vertical
Power	AC 230V/50Hz



No	Mark	Frequency MHz)	Measure Level	Reading Level	Over Limit	Limit (dBuV/m)	Probe (dB/m)	Cable (dB)	Amp (dB)	Ant (POS (cm)	Table Pos (deg)	Type
1	*	33.395	19.103	25.205	-10.897	30.000	16.103	1.143	23.348	0	0	PK
2		215.997	17.518	28.304	-12.482	30.000	9.340	3.208	23.334	0	0	PK
3		479.110	22.573	23.538	-14.427	37.000	16.917	5.174	23.056	0	0	PK

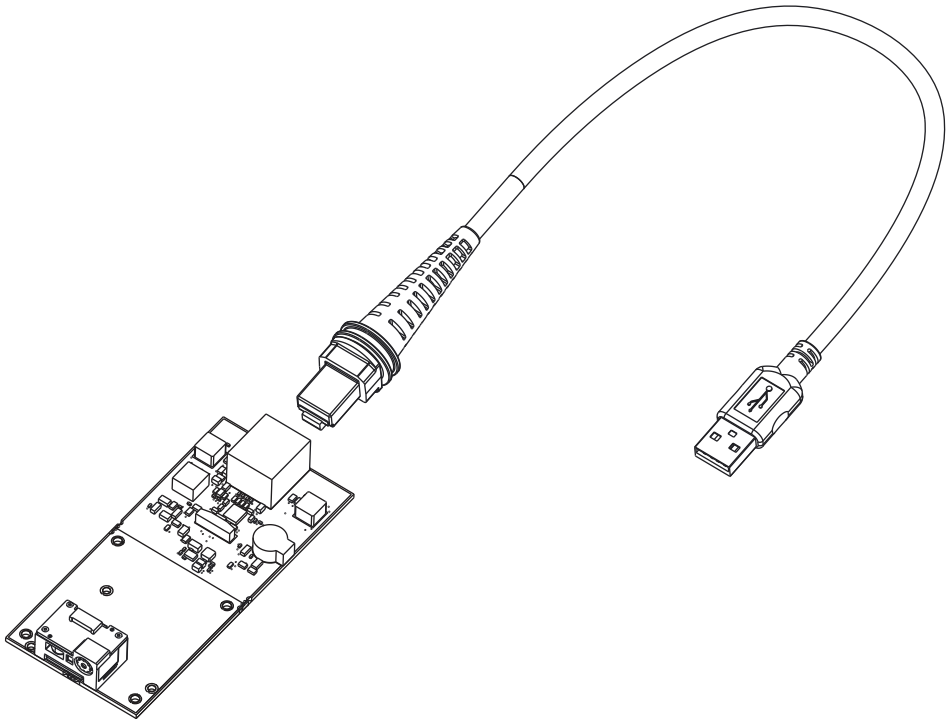
Note: All readings below 1GHz are quasi-peak. Readings below 1GHz are performed with peak and/or average measurements as necessary.

Note: "" means this data is the worst emission level.*

Note: Measurement Level = Reading Level + Factor (Probe+Cable+Amp).

Model 2: N36XX USB Unit

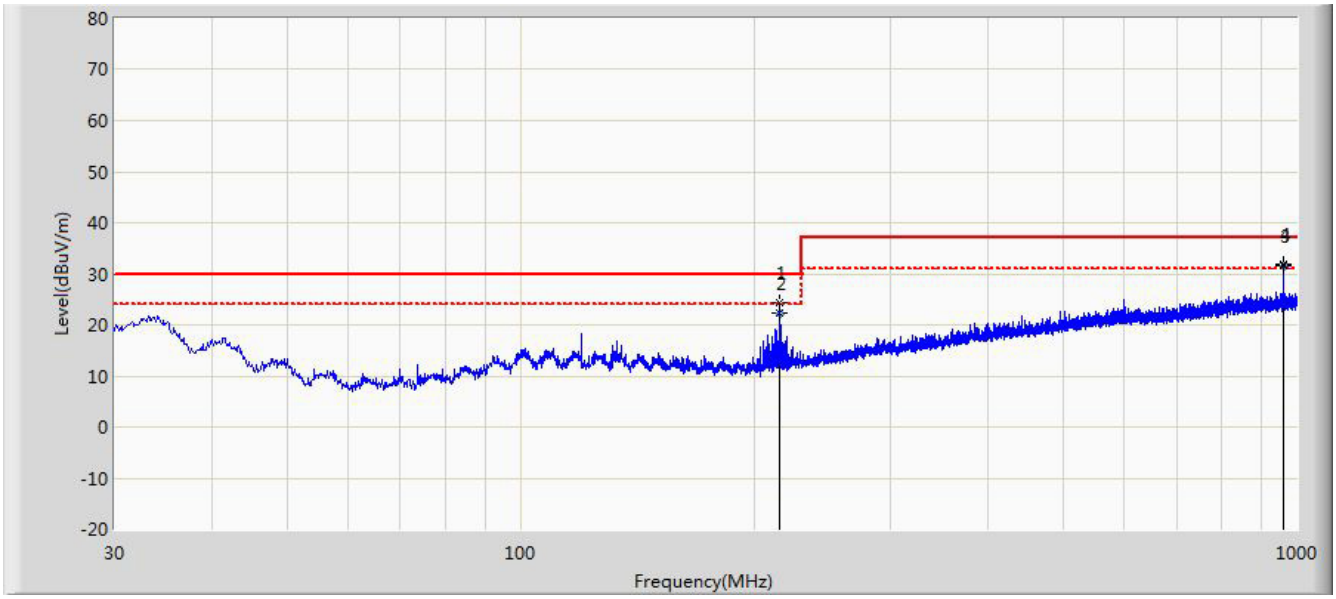
The illustration below shows a unit similar to the unit tested.



This system passed FCC Class B limits at all tested frequencies. The test results are shown in the following charts.

Model 2 - Radiated Emissions Measurements 30-1000 MHz (Horizontal)

Limit	EN55022_RE(10m)_Class B
Probe	CBL6112B_2931 (30-1000MHz)
EUT	N36XX USB
Margin	6
Polarity	Horizontal
Power	AC 230V/50Hz



No	Mark	Frequency MHz)	Measure Level	Reading Level	Over Limit	Limit (dBuV/m)	Probe (dB/m)	Cable (dB)	Amp (dB)	Ant (POS (cm)	Table Pos (deg)	Type
1		215.997	24.364	34.199	-5.636	30.000	9.499	2.878	22.213	0	0	PK
2		216.002	22.366	32.200	-7.634	30.000	9.499	2.879	22.212	400	67	QP
3		960.015	31.737	24.600	-5.263	37.000	20.977	7.069	20.910	100	308	QP
4	*	960.109	31.912	24.776	-5.088	37.000	20.975	7.070	20.909	0	0	PK

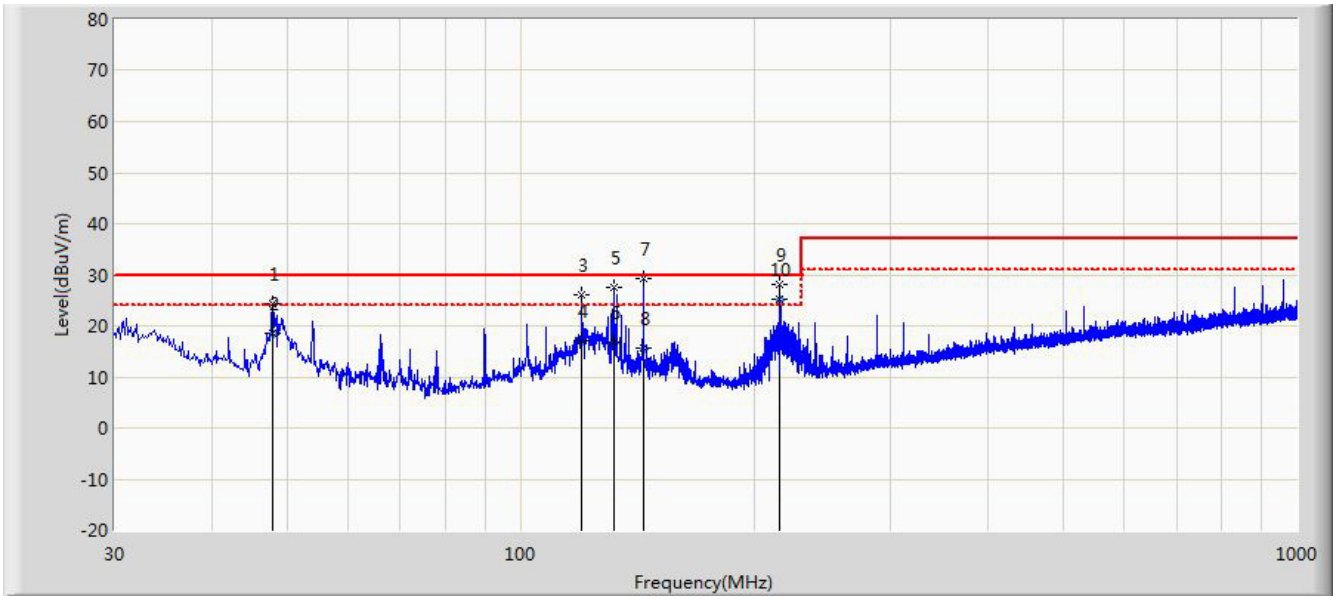
Note: All readings below 1GHz are quasi-peak. Readings below 1GHz are performed with peak and/or average measurements as necessary.

Note: "" means this data is the worst emission level.*

Note: Measurement Level = Reading Level + Factor (Probe+Cable+Amp).

Model 2 - Radiated Emissions Measurements 30-1000 MHz (Vertical)

Limit	EN55022_RE(10m)_Class B
Probe	CBL6112B_2933 (30-1000MHz)
EUT	N36XX USB
Margin	6
Polarity	Vertical
Power	AC 230V/50Hz



No	Mark	Fre-quency MHz)	Measure Level	Read-ing Level	Over Limit	Limit (dBuV/m)	Probe (dB/m)	Cable (dB)	Amp (dB)	Ant (POS (cm)	Table Pos (deg)	Type
1		47.945	24.238	37.676	-5.762	30.000	8.537	1.388	23.363	0	0	PK
2		47.998	18.535	32.000	-11.465	30.000	8.509	1.388	23.362	200	323	QP
3		119.967	26.001	37.020	-3.999	30.000	10.073	2.295	23.387	0	0	PK
4		119.997	16.981	28.000	-13.019	30.000	10.073	2.296	23.388	300	360	QP
5		131.850	27.474	38.500	-2.526	30.000	9.917	2.422	23.365	0	0	PK
6		132.021	16.767	27.800	-13.233	30.000	9.912	2.423	23.368	400	246	QP
7	*	143.975	29.325	40.521	-0.675	30.000	9.634	2.544	23.374	0	0	PK
8		143.995	15.704	26.900	-14.296	30.000	9.634	2.544	23.374	200	277	QP
9		215.997	28.099	38.885	-1.901	30.000	9.340	3.208	23.334	0	0	PK
10		216.001	25.215	36.000	-4.785	30.000	9.341	3.208	23.334	100	51	QP

Note: All readings below 1GHz are quasi-peak. Readings below 1GHz are performed with peak and/or average measurements as necessary.

Note: "" means this data is the worst emission level.*

Note: Measurement Level = Reading Level + Factor (Probe+Cable+Amp).

B Customer Validation Testing

Temperature Test

To insure that the image engine stays within the operating limits of the specification, the following test must be done with the engine integrated into the designated enclosure.

1. Attach the thermocouple for each engine model as shown below.
2. Configure the scan engine in the desired triggering mode and scan per use case.

Note: Continuous scanning (with no downtime) can produce undesired results.

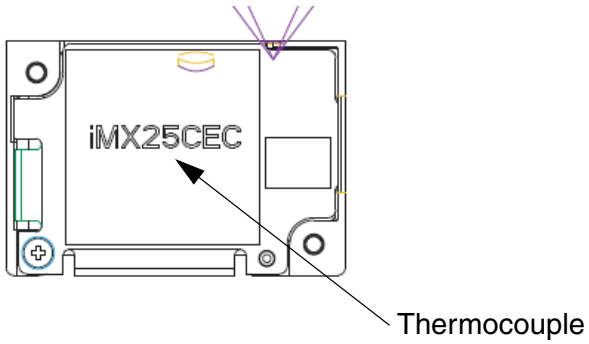
3. Place the integrated engine into the chamber at the maximum operating temperature (40°C).
4. Record the temperature at various intervals or after the temperature has stabilized.
5. Compare the results with the operating limits.

Note: Testing needs to be performed for each enclosure in which an engine will be used.

Operating Voltage

The operating voltage must be maintained within the engine's specified limits (see "Operating Voltage" on page 3-1).

Engine Bottom View



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