



SE3300 **INTEGRATION GUIDE**

SE3300

INTEGRATION GUIDE

72E-148589-01

Revision .8

September 2011

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Warranty

For the complete Motorola hardware product warranty statement, go to:
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Revision History

Changes to the original guide are listed below:

Change	Date	Description
-01 Rev A	9/2011	Initial release

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Appendix A: Register Settings

ABOUT THIS GUIDE

Introduction

The *SE3300 Integration Guide* discusses the theory of operation, installation, and specifications of the engine, and how to integrate the engine into data capture devices.



NOTE This guide provides general instructions for the installation of the engine into a customer's device. Motorola recommends that an opto-mechanical engineer perform an opto-mechanical analysis prior to integration.

Chapter Descriptions

This guide includes the following topics:

- [Chapter 1, Getting Started](#) provides an overview of the engine and the theory of operation.
- [Chapter 2, Installation](#) explains how to install the engine, including information on mounting, housing design, optical, grounding, ESD, and environmental considerations.
- [Chapter 3, Specifications](#) provides technical specifications for the engine, including decode ranges.
- [Chapter 4, Electrical Interface](#) includes signal information and connector drawings.
- [Chapter 5, Control Interface](#) describes the SE3300 bi-directional control interface.
- [Chapter 6, Application Notes](#) describes SE3300 operating modes.
- [Appendix A, Register Settings](#) provides information on register settings for the engine.

Notational Conventions

This document uses the following conventions:

- *Italics* are used to highlight chapters and sections in this and related documents
- bullets (•) indicate:
 - Action items
 - Lists of alternatives
 - Lists of required steps that are not necessarily sequential
- Sequential lists (e.g., those that describe step-by-step procedures) appear as numbered lists.



NOTE This symbol indicates something of special interest or importance to the reader. Failure to read the note will not result in physical harm to the reader, equipment or data.



CAUTION This symbol indicates that if this information is ignored, the possibility of data or material damage may occur.



WARNING! This symbol indicates that if this information is ignored the possibility that serious personal injury may occur.

Related Documents

- *PL3307 Decoder Integration Guide*, p/n 72E-149642-xx
- *The I²C-Bus Specification, Version 2.1*, <http://www.semiconductors.philips.com/acrobat/literature/9398/39340011.pdf>
- *Aptina MT9V022 (mono) Wide VGA CMOS Digital Image Sensor Datasheet*, <http://www.aplina.com>
- *Molex connector specification, 54809 Series*, <http://www.molex.com>
- *Kyocera connector specification, 6283 Series*, <http://global.kyocera.com>

For the latest version of this guide and all guides, go to: <http://supportcentral.motorola.com>.

Service Information

If you have a problem with your equipment, contact Motorola Solutions support for your region. Contact information is available at: <http://supportcentral.motorola.com>.

When contacting Motorola Solutions support, please have the following information available:

- Serial number of the unit
- Model number or product name
- Software type and version number.

Motorola responds to calls by e-mail, telephone or fax within the time limits set forth in support agreements.

If your problem cannot be solved by Motorola Solutions support, you may need to return your equipment for servicing and will be given specific directions. Motorola is not responsible for any damages incurred during shipment if the approved shipping container is not used. Shipping the units improperly can possibly void the warranty.

If you purchased your business product from a Motorola Solutions business partner, contact that business partner for support.

CHAPTER 1 GETTING STARTED



CAUTION This device emits IEC Class 1M LED light. Do not view directly with optical instruments.

Introduction

The SE3300 captures digital images for transmission to a host to decode a bar code of any format supported by the decoding software. The SE3300 uses LED aiming and illumination, and is available in the following three models to accommodate working range or more precise focusing in high-density bar code decoding or digital picture taking:

- SE3300SR - Standard working range
- SE3300WA - Wide angle
- SE3300HD - High density

SE3300

The SE3300 contains:

- a monochrome CMOS image sensor
- an LED based aiming system
- an illumination system
- a standardized camera interface port and bi-directional control interface (I²C)

Figure 1-1 provides a block diagram of the imager system.

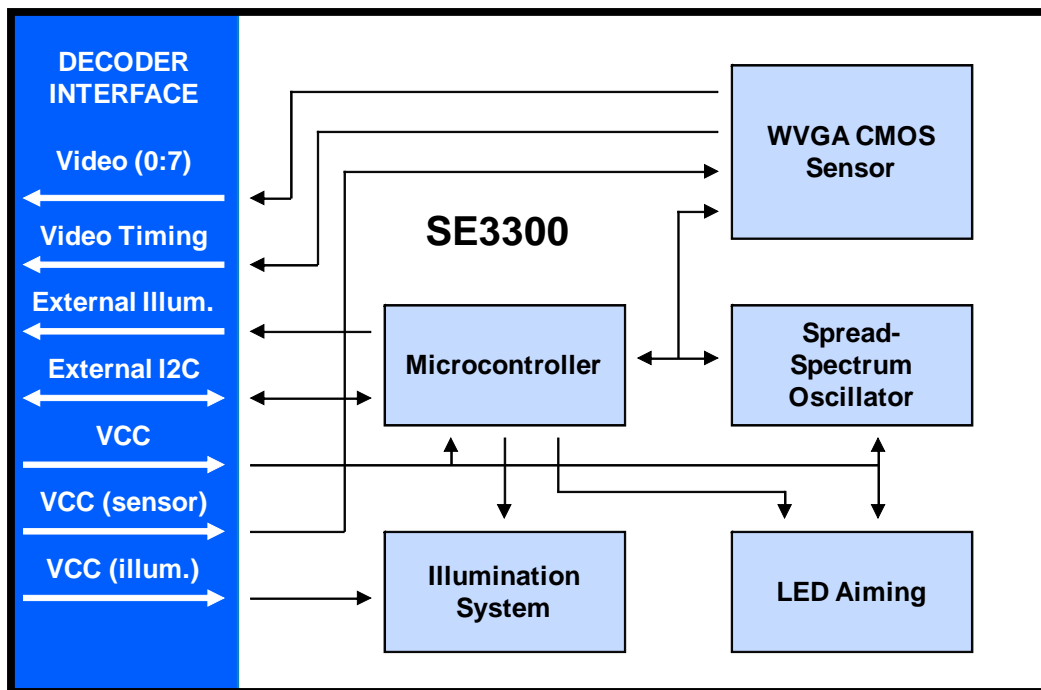


Figure 1-1 SE3300 Block Diagram

A 21-pin ZIF connector on the SE3300 connects the engine and the host device via a 55 mm flex (available from Motorola). For information about this connector, see [Figure 4-3 on page 4-4](#) and [Figure 4-5 on page 4-6](#).

An amber LED and associated optics generate an aiming pattern, and dual, high output LEDs provide illumination for the imager under virtually any lighting condition. The aiming subsystem, illumination system, and frame rate are under dynamic software control.

The primary component of the SE3300 imager is a 1/3" format CMOS wide VGA (752 H x 480 V) monochrome digital image sensor. The CMOS sensor converts photons to a digital representation (8 bits per pixel) of the image present on the sensor.

Aiming System

A 617 nm LED is used to generate a circular aiming pattern which indicates the center of the imager's field of view.

Aiming Pointing

The aiming pattern is rotated by 2.1° relative to the imaging axis in the vertical plane to minimize parallax between the aiming axis and the imaging axis at 204 mm (8 in.) from the engine.

Aiming Control

The SE3300 can capture images with both the aiming subsystem turned on during exposure (the image of the aiming pattern is visible in the digital image) or off. If the aiming system is turned off during exposure, brightness of the aiming pattern decreases as exposure increases.

The aiming subsystem can also be turned off completely. Motorola recommends shutting aiming off three frames prior to capturing documents to prevent the aiming pattern from appearing faintly in captured images. Note that this is not necessary for bar code decoding.

Illumination System

The illumination system consists of two high-output, red LEDs (625 nm) and a sophisticated drive system that allows image capture and decoding throughout a full range of lighting conditions (total darkness to full sunlight).

Illumination Control

The SE3300 can capture images with the illumination subsystem turned on or off, accommodating images that are close to the wavelength of the illumination. For example, since the engine uses red LED illumination, it may be desirable to shut off the illumination when capturing an image printed in red ink.

LED illumination can also be turned off when taking images of documents printed on semi-glossy or glossy paper or on a substrate with security marks. In this case, ensure ambient illumination provides minimum 30 fcd on the document surface. See also [Thermal Considerations on page 2-2](#).

Frame Rate Control

The SE3300 outputs images at 60 frames per second by default. When capturing images, use lower frame rates to increase image brightness. The aiming pattern appears to blink when the frame rate is 30 fps or lower.

CHAPTER 2 INSTALLATION

Introduction

This chapter provides information for mounting and installing the SE3300, including physical and electrical considerations, and recommended window properties for the SE3300.

General Information

Electrostatic Discharge (ESD)

The SE3300 is protected from ESD events that can occur in an uncontrolled environment. Use care when handling this component and apply standard ESD handling procedures such as using grounding wrist straps and handling in a properly grounded work area.

Environment

The engine and decoder must be sufficiently enclosed to prevent dust from gathering on the aiming lens, imaging lens, and illumination system LEDs. Dust and other external contaminants eventually degrade engine performance. Motorola does not guarantee performance of the SE3300 when used in an exposed application.

Power Supply Noise

For reliable operation a low-noise power supply is required. Pay proper attention to power supply quality and testing to ensure the best possible performance from the SE3300. In bar code applications, up to 100 mV peak-to-peak noise is acceptable on all three power input pins (10 Hz to 100 kHz). For image capture applications, power supply noise for VCC_SENSOR must be limited to 30 mV (peak-to-peak), across the same frequency range. To improve image quality use an additional filter on VCC_SENSOR; to achieve optimal performance use a separate linear regulator to supply VCC_SENSOR. Switching power supplies for VCC_SENSOR are not recommended.

Thermal Considerations

The SE3300 engine includes several high-power components (e.g., sensor, LEDs) that dissipate heat during operation. The engine temperature can rise above ambient temperature when the engine is running at 60 frames per second with full illumination and aiming on. These extreme conditions can increase sensor noise, degrade image quality, and impact the engine's longevity. Use care when designing the SE3300 for integration into the target application.

Other recommendations to reduce engine power consumption and heat removal include but are not limited to:

- Using reduced frame rates (e.g., 15 fps)
- Reducing internal illumination intensity
- Mounting on a solid metallic surface that facilitates heat removal
- Selecting a housing design that allows for natural or forced convection

Note that running in continuous 60 fps with both aiming and illumination enabled full time is highly uncommon. In typical decoding and image capture applications, any rise in engine temperature is minimal.

External Optics (Aiming LED Lens and Imaging Lens)

Do not subject external optical components on the SE3300 engine to any external force. Do not hold the engine by an external optical component. This can place excessive stress in the mechanical joints that secure the components, which can cause failures such as joint cracking or breaking.

Image and Document Capture

For specific information on image and document capture applications, contact a Motorola sales representative for a technical document on image capture using the SE3300.

Regulatory Information

The SE3300 imager engine meets the accessible LED light limits for an IEC Class 1M LED product. Any product containing the SE3300 can meet these same regulations. Contact a Motorola sales representative for further details.

For devices intended for international sale, see the IEC/EN60825-1:2001 standard.

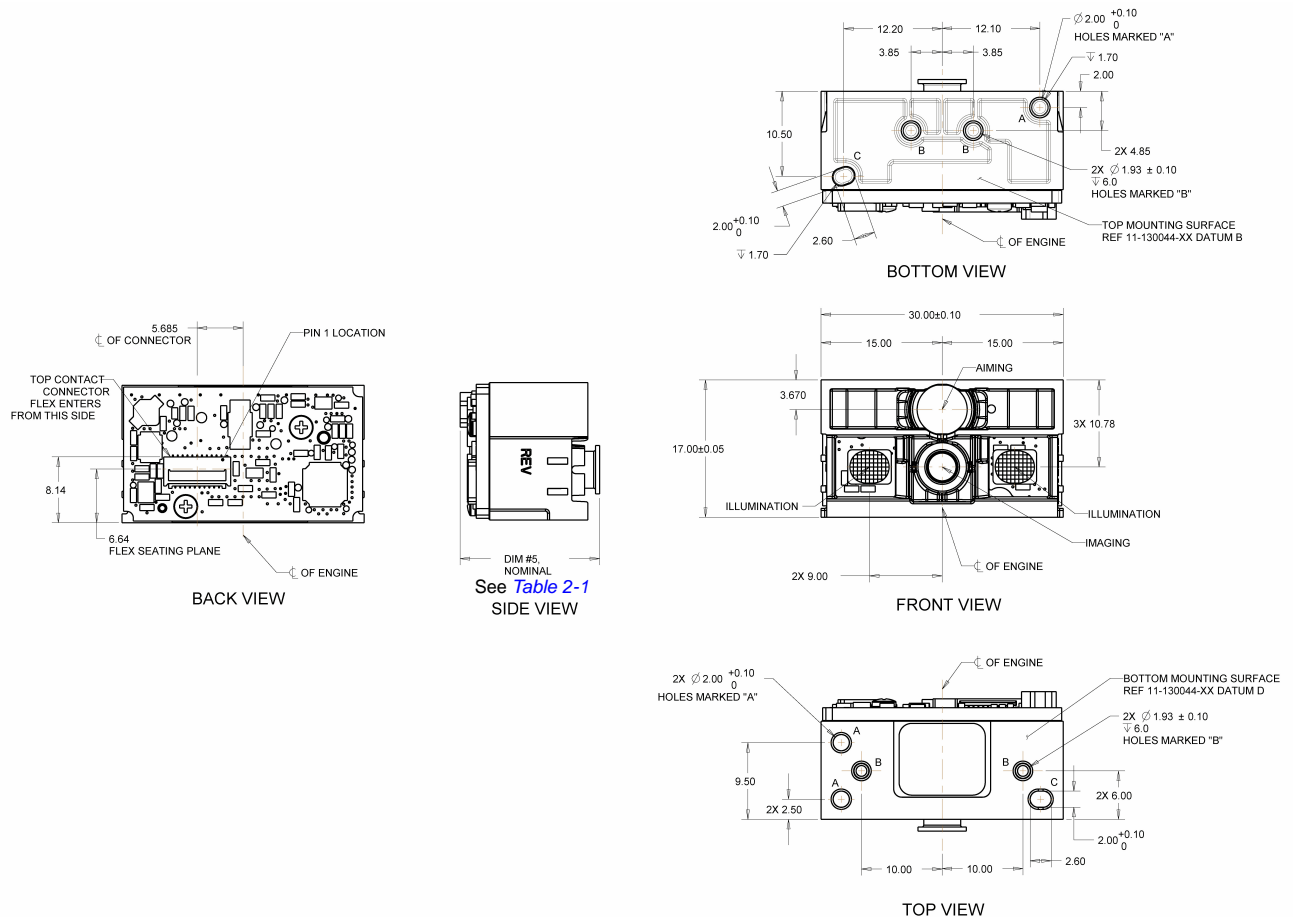
Complies with IEC 60825-1:2001 (for LED devices).

Mounting

There are two untapped mounting holes and three locating aides on the top surface of the chassis. Additionally, there are two untapped mounting holes and two locating aides on the bottom surface of the chassis. The SE3300 can be mounted in any orientation without degradation in performance. See [Figure 2-1](#).

✓ **NOTE** Mounting the SE3300 in a non-upright position results in images rotated accordingly in snapshot mode.

Installation requires #2-32 thread-cutting screws with a maximum engagement depth of 5.5 mm. Recommended mounting screw torque is 3.5 in-lb.



Notes: Unless otherwise specified:

- Holes marked "B" are mounting holes. Holes marked "A" and slots marked "C" are imager engine locating aides.
- This is a reference drawing and is not intended to specify or guarantee all possible integration requirements for this engine.
- All untoleranced dimensions follow a general tolerance of +/- 0.15 mm.

Figure 2-1 SE3300 Mounting Diagram

Table 2-1 *Imaging Field of View (FOV) and Focus Positions*

Specification	SE3300WA (Wide Angle)	SE3300SR Standard	SE3300HD High Density
Nom FOV (X x Y)	46.1° x 30.4°	39.2° x 25.4°	38.4° x 24.9°
Max FOV (X x Y)	50.1° x 34.4°	42.7° x 28.9°	42.7° x 28.9°
Dimensions #3	1.429 mm	1.154 mm	1.429 mm
Dimensions #5	17.249 mm	16.974 mm	17.249 mm
Dimensions #6	1.63 mm	2.16 mm	1.89 mm

Housing Design

✓ **NOTE** Perform an opto-mechanical analysis for the housing design to ensure optimal scanning or imaging performance.

Design the engine's housing so that internal reflections from the aiming and illumination system are not directed back toward the engine. The reflections from the window or housing can cause problems, and for particular window tilt angles, these reflections can bounce off the top or bottom of the housing and reach the engine. Also, keep all housing elements outside the imaging field of view and usable illumination volume (see [Figure 2-2 on page 2-7](#) and [Figure 2-3 on page 2-8](#)). Avoid any bright objects around the engine that can be reflected by a tilted window into the engine field of view and appear in a captured image.

[Recommended Exit Window Information on page 2-9](#) provides minimum exit window tilt angles. These dimensional requirements can vary. Consider using baffles or matte-finished dark internal housing colors.

Optical

The SE3300 uses a sophisticated optical system that provides imaging performance that matches or exceeds the performance of much larger imagers. However, an improperly designed enclosure, or improper selection of window material, can affect the performance of the SE3300.

Positioning the Exit Window

Position the window so that illumination system light reflected off the inside of the window is not reflected back into the engine (see [Recommended Exit Window Information on page 2-9](#)). If the designed enclosure cannot accommodate the recommended window angle, contact Motorola to discuss positioning requirements. An improperly positioned window can significantly decrease performance.

Tilted Window

Use a tilted window for window positioning. Adhere to the minimum window tilt specifications in [Table 2-6 on page 2-9](#). With tilted window installation, 2-sided anti-reflection coating is optional (see [Anti-Reflection Coatings on page 2-6](#)).

Avoiding Scratched Windows

Scratches on the window can greatly reduce the performance of the imaging system. Motorola recommends recessing the window into the housing or applying a scratch resistance coating.

Window Material

Many window materials that look clear can contain stresses and distortions that reduce performance. For this reason, use only cell-cast plastics or optical glass (with or without an anti reflection coating, depending on the application). Following are descriptions of three popular window materials: chemically tempered float glass, PMMA, and ADC (CR-39™). [Table 2-2](#) outlines the suggested window properties.

Table 2-2 Suggested Window Properties

Property	Description
Material	Clear cell-cast acrylic
Thickness	0.06 in. (1.5 mm)
Wavefront Distortion (transmission)	0.2 wavelengths peak-to-valley maximum and 0.04 λ maximum rms over any 0.08 in. diameter within the clear aperture
Clear Aperture	To extend to within 0.04 in. of the edges all around
Surface Quality	60-20 scratch/dig

Chemically Tempered Float Glass

The preferred window material, glass is hard and provides excellent scratch and abrasion resistance. However, unannealed glass is brittle. Increasing flexibility strength with minimal optical distortion requires chemical tempering. Glass cannot be ultrasonically welded and is difficult to cut into odd shapes.

Plastics

Plastic materials are not recommended for tilted windows since surface scratches cause image artifacts. Colored windows are not recommended if motion detection mode (e.g., presentation mode) is required since it reduces engine sensitivity to the moving target. If using plastic is necessary, the following two materials are available.

Cell Cast Acrylic (ASTM: PMMA)

Cell Cast Acrylic, or Poly-methyl Methacrylic (PMMA) is fabricated by casting acrylic between two precision sheets of glass. This material has very good optical quality, reasonably good impact resistance and low initial cost, but is relatively soft and susceptible to attack by chemicals, mechanical stresses, and UV light. Therefore polysiloxane coating is strongly recommended. Acrylic can be laser cut into odd shapes and ultrasonically welded.

Cell Cast ADC (ASTM: ADC)

Also known as CR-39™, Allyl Diglycol Carbonate (ADC) is a thermal-setting plastic produced by cell-casting. Most plastic eyeglasses sold today are uncoated, cell-cast CR-39. This material has excellent chemical and environmental resistance, and reasonably good impact resistance. It also has quite good surface hardness, and therefore does not have to be hard-coated, but may be coated for severe environments. This material cannot be ultrasonically welded.

Commercially Available Coatings

Anti-Reflection Coatings

Anti-reflection coatings can be used for stray light control or to achieve maximum working range, and can be applied to the inside and/or outside of the window to reduce the amount of light reflected off the window back into the engine. However, they are expensive and have very poor abrasion and scratch resistance.

Polysiloxane Coating

Polysiloxane type coatings are applied to plastic surfaces to improve the surface resistance to both scratch and abrasion. To apply, dip and air dry in an oven with filtered hot air.

To gauge a window's durability, use ASTM standard D1044, Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion (the Taber Test), which quantifies abrasion resistance as a percent increase in haze after a specified number of cycles and load. Lower values of haze measurement correspond to better abrasion and scratch resistance. See [Table 2-3](#).

Table 2-3 *Taber Test Results on Common Exit Window Materials*

Sample	Haze 100 cycles	Haze 500 cycles	Abrasion Resistance
Chemically Tempered Float Glass	1.20%	1.50%	Best
PMMA with Polysiloxane Hardcoat	3%	10%	
ADC	5%	30%	
PMMA	30%		Worst

*** All measurements use a 100 gram load and CS-10F Abraser.**

A Word About Coatings

If using an anti-reflective (AR) coating, the specifications in [Table 2-4](#) apply. Polysiloxane coating is not required. Recess the exit window to minimize scratches and digs.

Table 2-4 *AR Coatings Specifications*

Specification	Description
Material	Both tempered glass and plastic (e.g., CR-39 or hard coated acrylic) exit windows can be AR coated. AR coated glass is easier and more durable because of a better adhesion property on the glass structure. In addition, it can be more cost effective to put an AR coating on the glass substrate rather than on the plastic.
AR Coating Specification	<ul style="list-style-type: none"> One side tempered AR coating: 92% minimum within spectrum range from 450 nm to 700 nm. Double side AR coating: One side AR coating must be 97% minimum within spectrum range from 450 nm to 700 nm.

Optical Path and Exit Window

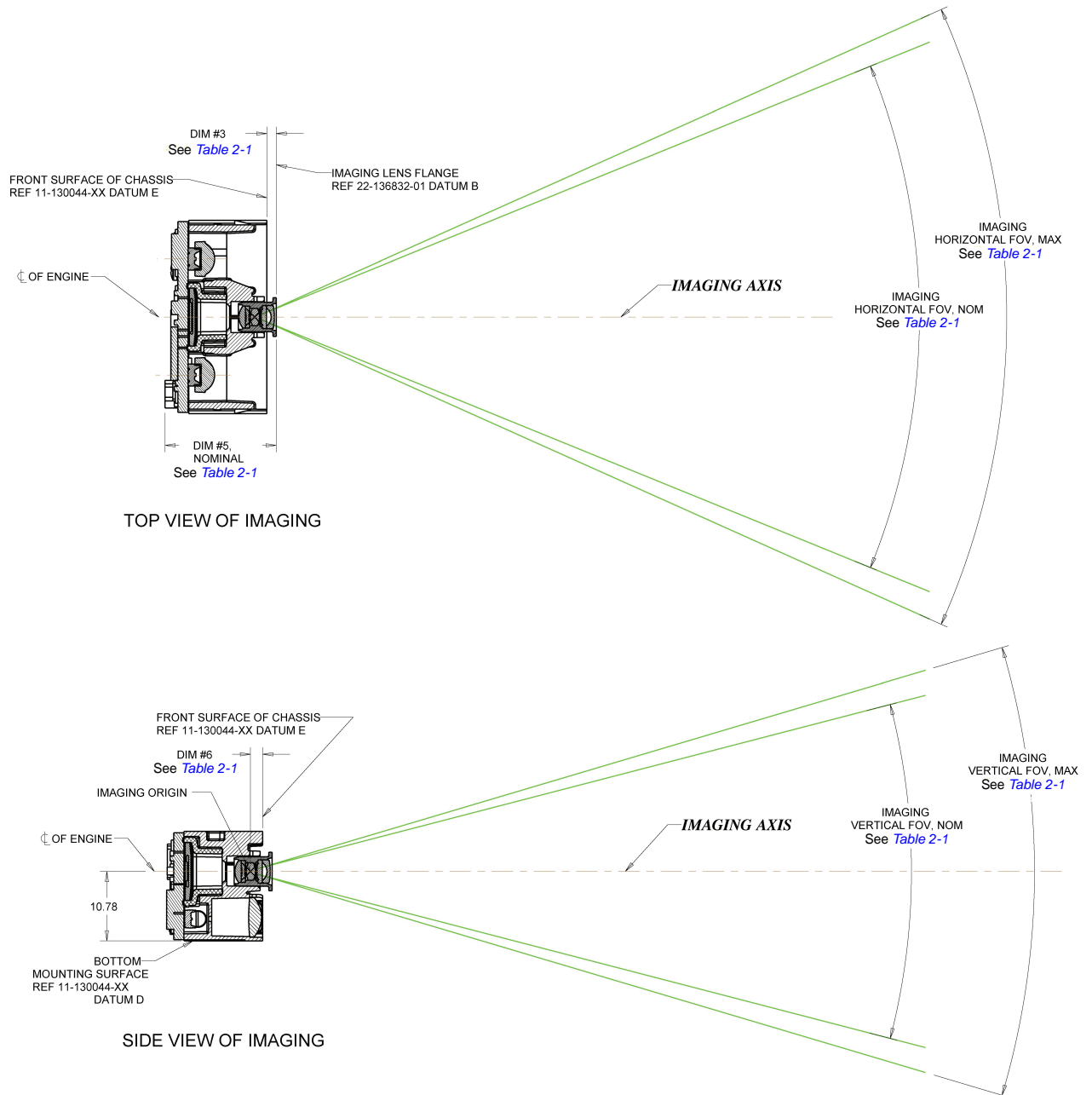


Figure 2-2 SE3300 Optical Path

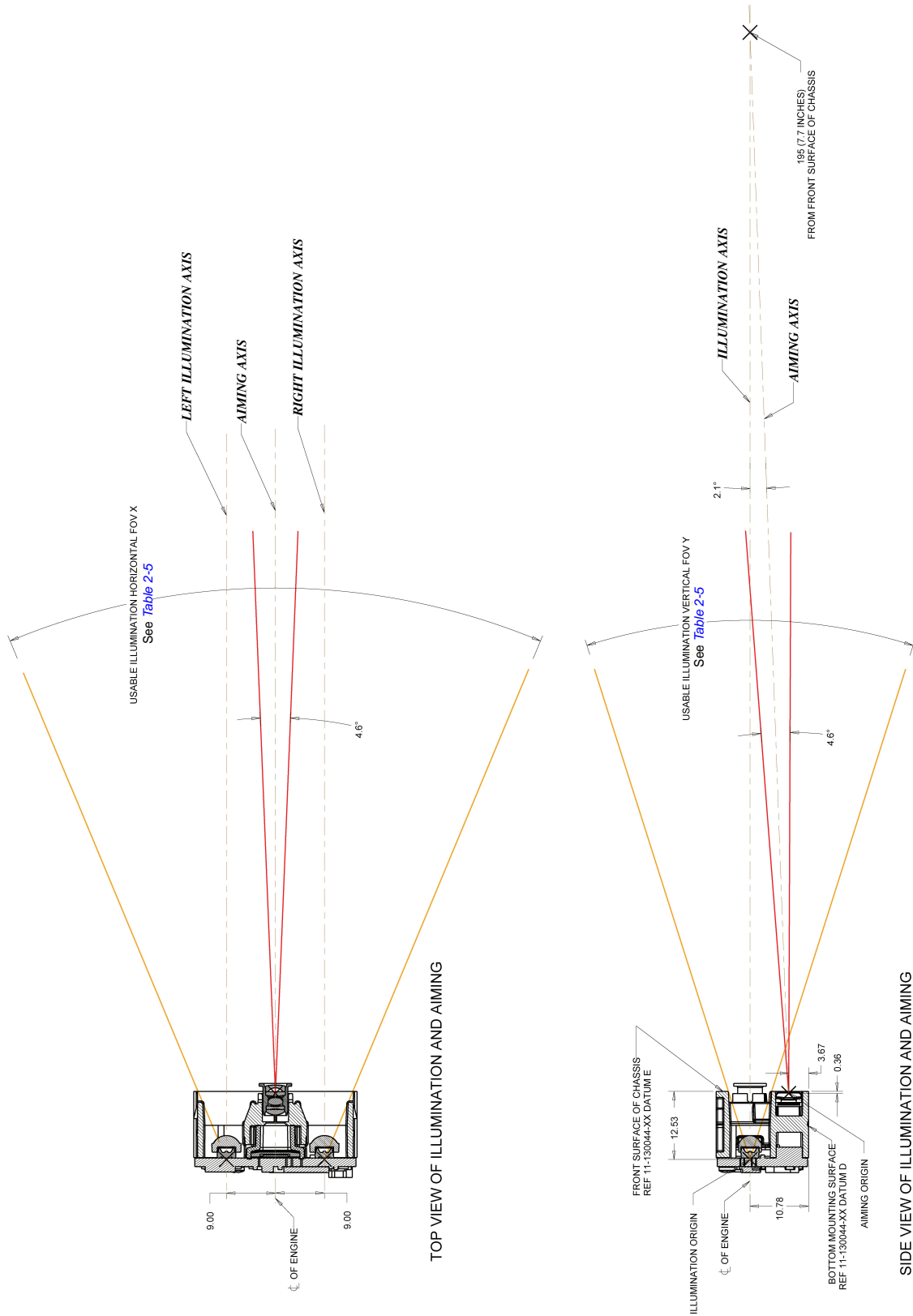


Figure 2-3 SE3300 Illumination and Aiming Path

Table 2-5 Usable Illumination Volume for Imaging FOV Within 20 Inch Range

Specification	SE3300WA (Wide Angle)	SE3300SR (Standard)	SE3300HD (High Density)
FOV (X x Y)	47.6° x 33.7°	40.2° x 28.3°	40.2° x 28.3°

Recommended Exit Window Information

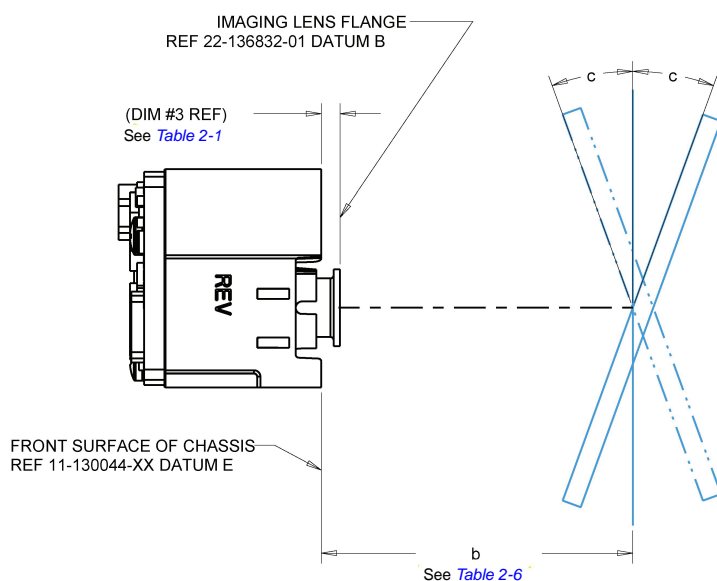


Figure 2-4 Window Distances

Table 2-6 Minimum Exit Window Tilt Angle (c) Required for Integration

Engine Model/ Part Number	Window Specification	Distance (b) Front Surface of Chassis to Exit Window					
		6 mm	11 mm	16 mm	21 mm	26 mm	31 mm
SE3300WA	Non-coated	34°	33°	25°	24°	23°	22°
	Anti-reflective (AR) coated, one side (facing engine)	32°	31°	25°	24°	23°	22°
	AR coated, two sides	18°	18°	18°	18°	18°	18°
SE3300SR SE3300HD	Non-coated	31°	28°	27°	21°	20°	19°
	AR coated, one side (facing engine)	31°	28°	27°	21°	20°	19°
	AR coated, two sides	15°	15°	15°	15°	15°	15°

Exit Window Notes

- Integration tolerances are not included.
- Ensure the window size is large enough to cover the imaging field of view and usable illumination volume specified in [Figure 2-2](#) and [Figure 2-3](#) plus mounting tolerances of the window relative to the engine.

CHAPTER 3 SPECIFICATIONS

Introduction

This chapter provides the technical specifications of the SE3300, including decode zone and exit window characteristics.

Technical Specifications

Table 3-1 SE3300 Technical Specifications

Item	Description	
Power Requirements - Input Voltage	3.3 V \pm 0.3 V at 23° C	
Operating Mode Supply Currents (conditions VCC=VCC_SENSOR=VCC_ILLUM = 3.3VDC) (at 23° C):		
Low Power	SE3300SR / SE3300HD: 500 μ A	SE3300WA: 500 μ A
Idle	18 mA	18 mA
Image Acquisition	80 mA	80 mA
Illumination Enabled	250 mA	200 mA
Maximum Operating Current (aiming on during exposure, illumination enabled)	275 mA	250 mA
Maximum Sensor Power Supply Noise* (at 23° C)	100 mVp-p (3.3 V, 10 Hz - 100 kHz) for decoding 30 mVp-p (3.3 V, 10 Hz - 100 kHz) for image capture	

*For better image quality in image capture applications, use an additional filter on VCC_SENSOR. For additional performance improvement, provide a separately regulated 3.3 V supply for the sensor.

Table 3-1 SE3300 Technical Specifications (Continued)

Item	Description
Optical Resolutions	SR / WA focus: 4.0 mil (Code 39), 5.0 mil (PDF417), 7.5 mil (Data Matrix) HD focus: 3.0 mil (Code 39), 4.0 mil (PDF417), 5.0 mil (Data Matrix)
Specular Dead Zone Illumination On Illumination Off	Up to 20° depending on target distance and substrate glossiness None
Skew Tolerance	± 60° (see Figure 3-1 on page 3-3)
Pitch Angle	± 60° (see Figure 3-1 on page 3-3)
Roll	360° (see Figure 3-1 on page 3-3)
Ambient Light Immunity (Sunlight)	8000 ft. candles (86,100 lux)
Imaging Sensor Image Resolution Gray Scale Field of View (FOV)	752 H x 480 V pixels (Wide VGA) 256 levels (8 bits per pixel) SE3300SR: 39.2° horizontal, 25.4° vertical SE3300WA: 46.1° horizontal, 30.4° vertical SE3300HD: 38.4° horizontal, 24.9° vertical
Focusing Distance from Front of Engine SR WA HD	5.2 in. / 13.3 cm 4.5 in. / 11.5 cm 2.7 in. / 6.9 cm
Aiming Element	Dot Optical Power : 0.19 mW (typical)
Illumination System LEDs Pattern Angle	625 ± 5 nm (dominant wavelength) 60° x 40° at 80% center intensity
Shock	2000 G ± 5% applied via any mounting surface at 0° C, 20° C, and 50° C for a period of 0.85 ± 0.05 msec
Vibration	Unpowered SE3300 withstands a random vibration along each of the X, Y, and Z axes for a period of one hour per axis, defined as follows: 20 to 80 Hz Ramp up at 0.02 G ² /Hz at 3 dB/octave 80 to 350 Hz 0.02 G ² /Hz 350 Hz to 2 kHz Ramp down at 0.02 G ² /Hz at 3 dB/octave
ESD	± 2 kV @ connector
LED Safety Class	IEC Class 1M
Temperature Operating Storage	0° to 50° C (32° to 122° F) -40° to 70° C (-40° to 158°F) See Thermal Considerations on page 2-2 for more information.

Table 3-1 SE3300 Technical Specifications (Continued)

Item	Description
Humidity Operating Storage	95% RH, non-condensing at 50° C 85% RH, non-condensing at 70° C
Engine Dimensions	17.00 mm H x 30.00 mm W x 17.25 mm D 0.669 in. H x 1.181 in. W x 0.679 in. D
Weight	6.1 grams (0.22 oz)
Electrical Interface	21 pin 0.3 mm pitch ZIF connector See Chapter 4, Electrical Interface for more information.

✓ **NOTE** Environmental and/or tolerance parameters are not cumulative. Motorola recommends a thermal analysis if the application is subject to an extreme temperature environment.

Skew, Pitch, and Roll

Measured on a 20 mil Code 39 symbol at a distance of 5 inches. Tolerance for skew and pitch is reduced at extreme ends of the working range.

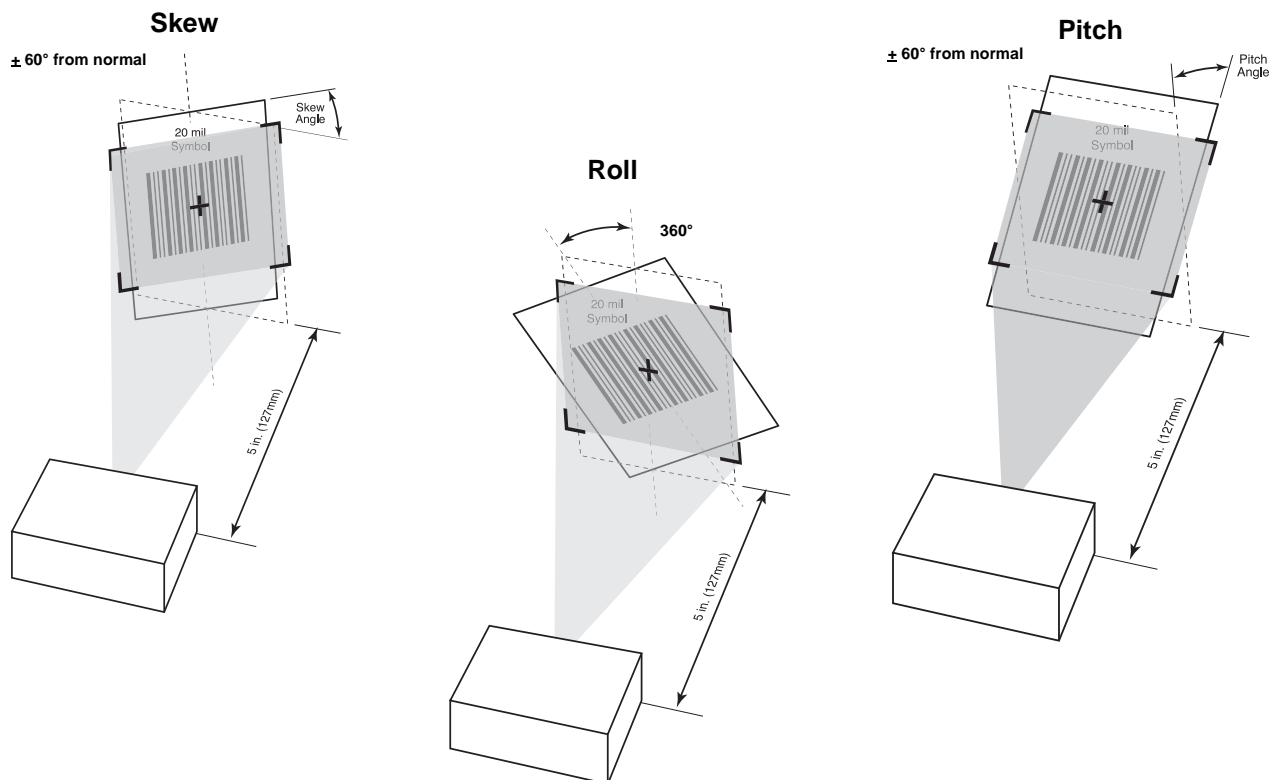


Figure 3-1 Skew, Pitch, and Roll

Decode Ranges

SE3300SR Ranges

Table 3-2 SE3300SR Decode Ranges

Code Type	Density	Bar Code Description	Range	Typical		Guaranteed	
				Inch	cm	Inch	cm
Code 39	3 mil	STI3025	Near	2.5	6.5	2.9	7.4
			Far	4.9	12.5	4.3	10.9
	4 mil	STI4026	Near	1.9	4.9	2.3	5.7
			Far	7.2	18.3	6.9	17.5
	5 mil	ABCDEFGH	Near	1.5	3.8	1.9	4.7
			Far	8.2	20.8	7.7	19.4
	7.5 mil	ABCDEF	Near	Note 1			
			Far	11.3	28.6	10.9	27.6
	10 mil	ABCDE	Near	Note 1			
			Far	14.3	36.3	13.2	33.6
	20 mil	123	Near	Note 1			
			Far	25.8	65.6	24.0	60.9
60% UPC	7.8 mil	12345678905	Near	1.1	2.9	1.5	3.8
			Far	10.5	26.6	9.5	24.2
80% UPC	10.4 mil	12345678905	Near	1.5	3.8	2.2	5.7
			Far	13.3	33.8	12.3	31.1
100% UPC	13 mil	12345678905	Near	1.9	4.9	2.8	7.2
			Far	17.5	44.4	16.8	42.6
200% UPC	26 mil	13579256809	Near	3.6	9.1	4.5	11.4
			Far	28.9	73.4	27.1	68.8

Notes:

1. Near distance is Field of View (FOV) limited.

2. Contrast is measured as Mean Reflective Difference (MRD) at 670 nm.

3. Working range specifications at temperature = 23°C, pitch=10°, roll=0°, skew=0°, photographic quality, ambient light ~20 ft-c, humidity 45-70%RH.

Table 3-2 SE3300SR Decode Ranges (Continued)

Code Type	Density	Bar Code Description	Range	Typical		Guaranteed		
				Inch	cm	Inch	cm	
Code 128	5 mil	C128 MOT	Near	2.1	5.3	2.4	6.1	
			Far	6.2	15.7	5.7	14.4	
	20 mil	20MIL C128	Near	Note 1				
			Far	23.3	59.1	21.2	54.0	
1 2 of 5	10 mil	1234567897	Near	Note 1				
			Far	14.3	36.4	13.7	34.9	
PDF417	5 mil	x.005y.0150	Near	3.1	7.8	3.5	8.9	
			Far	5.5	13.9	5.0	12.8	
	6.67 mil	x.0066y.0200	Near	2.2	5.5	2.7	6.8	
			Far	7.5	19.1	7.0	17.9	
	10 mil	x.0100y.0300	Near	Note 1				
			Far	10.3	26.1	9.8	25.0	
	15 mil	x.0150y.0450	Near	Note 1				
			Far	14.4	36.6	13.2	33.5	
	Datamatrix	5 mil	1234567890 (6 times)	Near	3.4	8.6	3.7	9.5
				Far	4.3	10.9	3.5	8.8
7.5 mil		1234567890 (6 times)	Near	2.4	6.1	2.9	7.4	
			Far	6.8	17.3	6.2	15.8	
10 mil		1234567890 (6 times)	Near	Note 1				
			Far	8.9	22.7	8.3	21.0	
15 mil		1234567890 (6 times)	Near	Note 1				
			Far	12.1	30.6	11.5	29.3	
QR Code	10 mil	1234567890 (6 times)	Near	Note 1				
			Far	7.4	18.8	6.9	17.7	

Notes:

1. Near distance is Field of View (FOV) limited.
2. Contrast is measured as Mean Reflective Difference (MRD) at 670 nm.
3. Working range specifications at temperature = 23°C, pitch=10°, roll=0°, skew=0°, photographic quality, ambient light ~20 ft-c, humidity 45-70%RH.

SE3300WA Ranges

Table 3-3 SE3300WA Decode Ranges

Code Type	Density	Bar Code Description	Range	Typical		Guaranteed		
				Inch	cm	Inch	cm	
Code 39	3 mil	STI3025	Near	2.4	6.1	2.9	7.3	
			Far	4.3	10.9	3.7	9.5	
	4 mil	STI4026	Near	2.0	5.1	2.4	6.1	
			Far	6.3	16.1	5.6	14.2	
	5 mil	ABCDEFGH	Near	1.7	4.3	2.0	5.1	
			Far	7.0	17.7	6.2	15.8	
	7.5 mil	ABCDEF	Near	Note 1				
			Far	10.0	25.4	9.3	23.7	
	10 mil	ABCDE	Near	Note 1				
			Far	12.7	32.3	11.2	28.5	
	20 mil	123	Near	Note 1				
			Far	19.3	49.0	16.5	42.0	
	60% UPC	7.8 mil	12345678905	Near	1.2	3.1	1.7	4.4
				Far	9.1	23.2	8.0	20.3
80% UPC	10.4 mil	12345678905	Near	1.4	3.4	2.0	5.0	
			Far	11.4	28.9	9.8	24.8	
100% UPC	13 mil	12345678905	Near	1.6	4.2	2.6	6.5	
			Far	13.2	33.5	11.0	27.9	
200% UPC	26 mil	13579256809	Near	3.1	7.9	4.2	10.6	
			Far	19.5	49.5	16.3	41.3	
Code 128	5 mil	C128 MOT	Near	2.1	5.2	2.5	6.4	
			Far	5.4	13.6	4.7	11.8	
	20 mil	20MIL C128	Near	Note 1				
			Far	16.4	41.7	13.2	33.6	

Notes:

1. Near distance is Field of View (FOV) limited.
2. Contrast is measured as Mean Reflective Difference (MRD) at 670 nm.
3. Working range specifications at temperature = 23°C, pitch=10°, roll=0°, skew=0°, photographic quality, ambient light ~20 ft-c, humidity 45-70%RH.

Table 3-3 SE3300WA Decode Ranges (Continued)

Code Type	Density	Bar Code Description	Range	Typical		Guaranteed	
				Inch	cm	Inch	cm
1 2 of 5	10 mil	1234567897	Near	Note 1			
			Far	12.0	30.6	9.8	24.9
PDF417	5 mil	x.005y.0150	Near	2.8	7.0	3.4	8.8
			Far	5.1	12.8	4.7	11.8
	6.67 mil	x.0066y.0200	Near	2.2	5.5	3.1	7.9
			Far	6.5	16.6	5.7	14.5
	10 mil	x.0100y.0300	Near	Note 1			
			Far	8.4	21.3	6.6	16.8
	15 mil	x.0150y.0450	Near	Note 1			
			Far	10.7	27.2	8.8	22.3
Datamatrix	5 mil	1234567890 (6 times)	Near	3.1	7.8	4.1	10.3
			Far	3.9	9.9	3.4	8.6
	7.5 mil	1234567890 (6 times)	Near	2.3	5.7	2.7	6.8
			Far	6.1	15.4	5.6	14.2
	10 mil	1234567890 (6 times)	Near	Note 1			
			Far	7.6	19.3	6.6	16.8
	15 mil	1234567890 (6 times)	Near	Note 1			
			Far	10.1	25.6	8.5	21.6
QR Code	10 mil	1234567890 (6 times)	Near	Note 1			
			Far	6.5	16.4	6.0	15.1

Notes:

1. Near distance is Field of View (FOV) limited.

2. Contrast is measured as Mean Reflective Difference (MRD) at 670 nm.

3. Working range specifications at temperature = 23°C, pitch=10°, roll=0°, skew=0°, photographic quality, ambient light ~20 ft-c, humidity 45-70%RH.

SE3300HD Ranges

Table 3-4 SE3300HD Decode Ranges

Code Type	Density	Bar Code Description	Range:	Typical		Guaranteed		
				Inch	cm	Inch	cm	
Code 39	3 mil	STI3025	Near	1.5	3.7	1.8	4.7	
			Far	5.0	12.6	4.4	11.3	
	4 mil	STI4026	Near	1.0	2.7	1.4	3.6	
			Far	5.6	14.2	4.6	11.6	
	5 mil	ABCDEFGH	Near	1.1	2.7	1.5	3.9	
			Far	6.3	15.9	5.4	13.8	
	7.5 mil	ABCDEF	Near	Note 1				
			Far	7.3	18.5	6.4	16.3	
	10 mil	ABCDE	Near	Note 1				
			Far	8.4	21.3	6.9	17.6	
	20 mil	123	Near	Note 1				
			Far	12.2	31.0	10.2	26.0	
	60% UPC	7.8 mil	12345678905	Near	1.0	2.7	1.5	3.9
				Far	6.4	16.3	5.3	13.5
80% UPC	10.4 mil	12345678905	Near	1.5	3.9	2.2	5.6	
			Far	7.5	19.1	6.2	15.7	
100% UPC	13 mil	12345678905	Near	1.9	4.9	2.9	7.4	
			Far	8.7	22.0	6.7	17.0	
200% UPC	26 mil	13579256809	Near	3.6	9.1	4.3	11.0	
			Far	12.6	32.0	10.8	27.3	
Code 128	5 mil	C128 MOT	Near	1.2	3.1	1.8	4.6	
			Far	5.4	13.7	4.4	11.3	
	20 mil	20MIL C128	Near	Note 1				
			Far	10.8	27.3	8.6	21.9	

Notes:

1. Near distance is Field of View (FOV) limited.
2. Contrast is measured as Mean Reflective Difference (MRD) at 670 nm.
3. Working range specifications at temperature = 23°C, pitch=10°, roll=0°, skew=0°, photographic quality, ambient light ~20 ft-c, humidity 45-70%RH.

Table 3-4 SE3300HD Decode Ranges (Continued)

Code Type	Density	Bar Code Description	Range:	Typical		Guaranteed		
				Inch	cm	Inch	cm	
1 2 of 5	10 mil	1234567897	Near	Note 1				
			Far	8.2	20.9	6.8	17.4	
PDF417	4 mil	x.0040y.0120	Near	1.8	4.6	2.3	5.9	
			Far	3.9	10.0	3.2	8.0	
	5 mil	x.005y.0150	Near	1.5	3.7	1.9	4.9	
			Far	4.3	11.0	3.6	9.2	
	6.67 mil	x.0066y.0200	Near	1.3	3.4	1.9	4.9	
			Far	4.9	12.5	4.2	10.6	
	10 mil	x.0100y.0300	Near	Note 1				
			Far	5.8	14.7	5.0	12.6	
	15 mil	x.0150y.0450	Near	Note 1				
			Far	7.4	18.9	6.3	16.0	
	Datamatrix	5 mil	1234567890 (6 times)	Near	1.7	4.4	2.3	5.8
				Far	4.0	10.3	3.3	8.4
7.5 mil		1234567890 (6 times)	Near	1.4	3.6	2.1	5.3	
			Far	4.7	12.1	3.9	10.0	
10 mil		1234567890 (6 times)	Near	Note 1				
			Far	5.7	14.4	4.9	12.4	
15 mil		1234567890 (6 times)	Near	Note 1				
			Far	6.9	17.4	5.9	15.1	
QR Code	10 mil	1234567890 (6 times)	Near	Note 1				
			Far	4.9	12.5	4.1	10.5	

Notes:

1. Near distance is Field of View (FOV) limited.
2. Contrast is measured as Mean Reflective Difference (MRD) at 670 nm.
3. Working range specifications at temperature = 23°C, pitch=10°, roll=0°, skew=0°, photographic quality, ambient light ~20 ft-c, humidity 45-70%RH.

CHAPTER 4 ELECTRICAL INTERFACE

Introduction

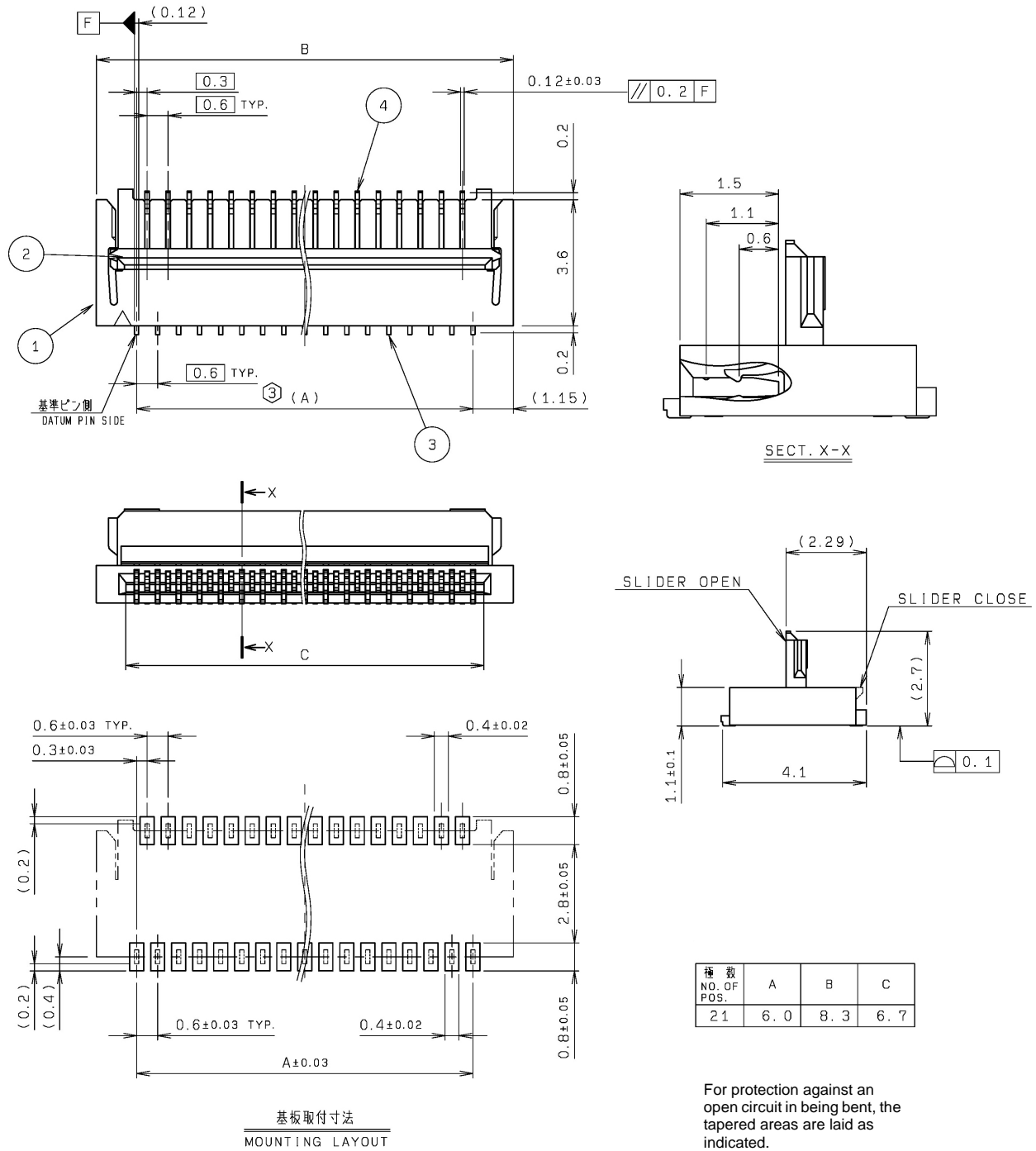
Table 4-1 lists the pins and signals of the 21-pin connector on the SE3300. See *Figure 2-1 on page 2-3* for the pin 1 location on the rear of the engine, on the side opposite the aiming/illumination system.

Table 4-1 SE3300 Signal Information

Pin Number	SE3300 Signal Name	I/O	Note
1	GND	-	Ground
2	GND	-	Ground
3	I2C_CLK	I	I ² C Clock
4	I2C_DATA	I/O	I ² C Data
5	VSYNC	O	Vertical sync
6	PIX_DATA_7	O	Sensor Pixel Data - MSB
7	PIX_DATA_6	O	Sensor Pixel Data
8	PIX_DATA_5	O	Sensor Pixel Data
9	PIX_DATA_4	O	Sensor Pixel Data
10	PIX_DATA_3	O	Sensor Pixel Data
11	PIX_DATA_2	O	Sensor Pixel Data
12	PIX_DATA_1	O	Sensor Pixel Data
13	PIX_DATA_0	O	Sensor Pixel Data - LSB
14	EXT_ILLUM_EN	O	External illumination trigger
15	VCC_SENSOR	-	WVGA sensor power
16	VCC	-	Aim LED and logic power
17	VCC_ILLUM	-	Illumination power
18	HSYNC	O	Horizontal sync
19	GND	-	Ground
20	PIXCLK	O	Sensor pixel clock
21	GND	-	Ground

Connector Drawings

For detailed connector information, refer to the manufacturer's specifications.



For protection against an open circuit in being bent, the tapered areas are laid as indicated.

Figure 4-1 21-Pin ZIF Connector (SE3300 Imager to Flex), Kyocera 6283 Series

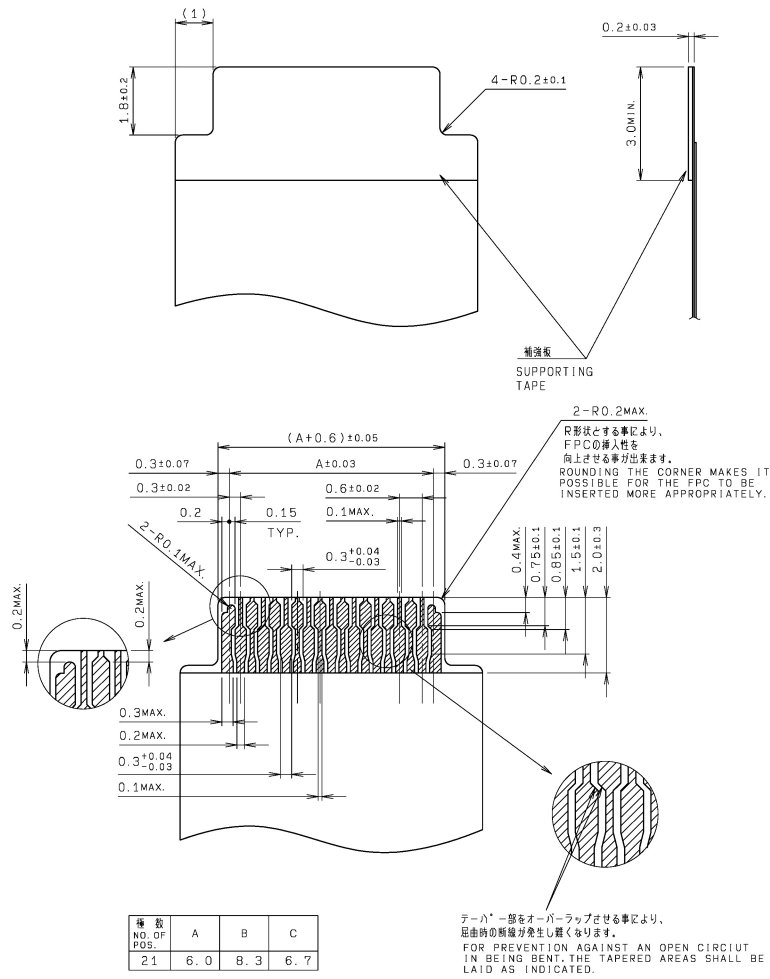


Figure 4-2 21-Pin ZIF Connector (SE3300 Imager to Flex), Kyocera 6283 Series (continued)

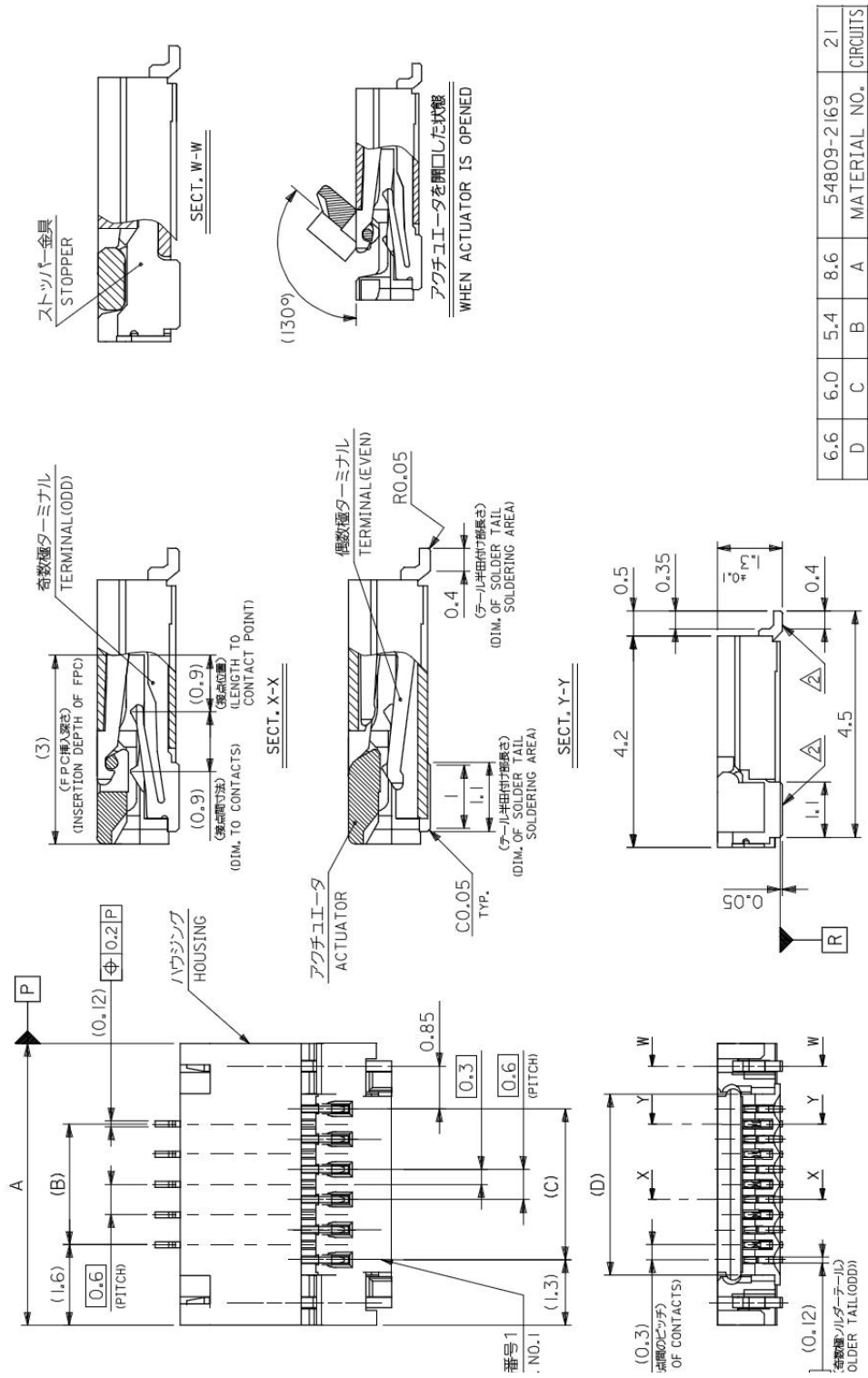


Figure 4-3 21-Pin ZIF Connector (PL3307 Decoder to Flex), Molex 54809 Series

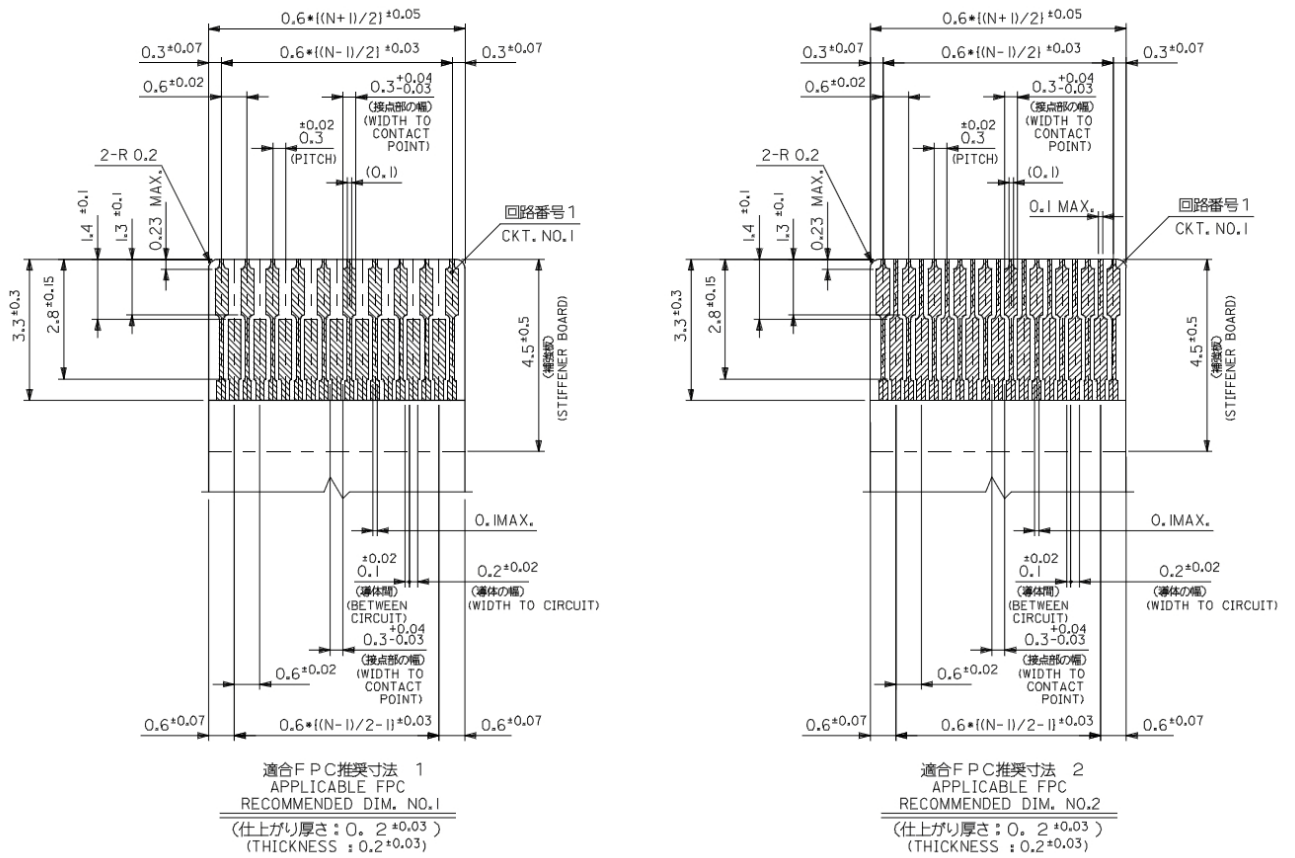


Figure 4-4 21-Pin ZIF Connector (PL3307 Decoder to Flex), Molex 54809 Series (continued)

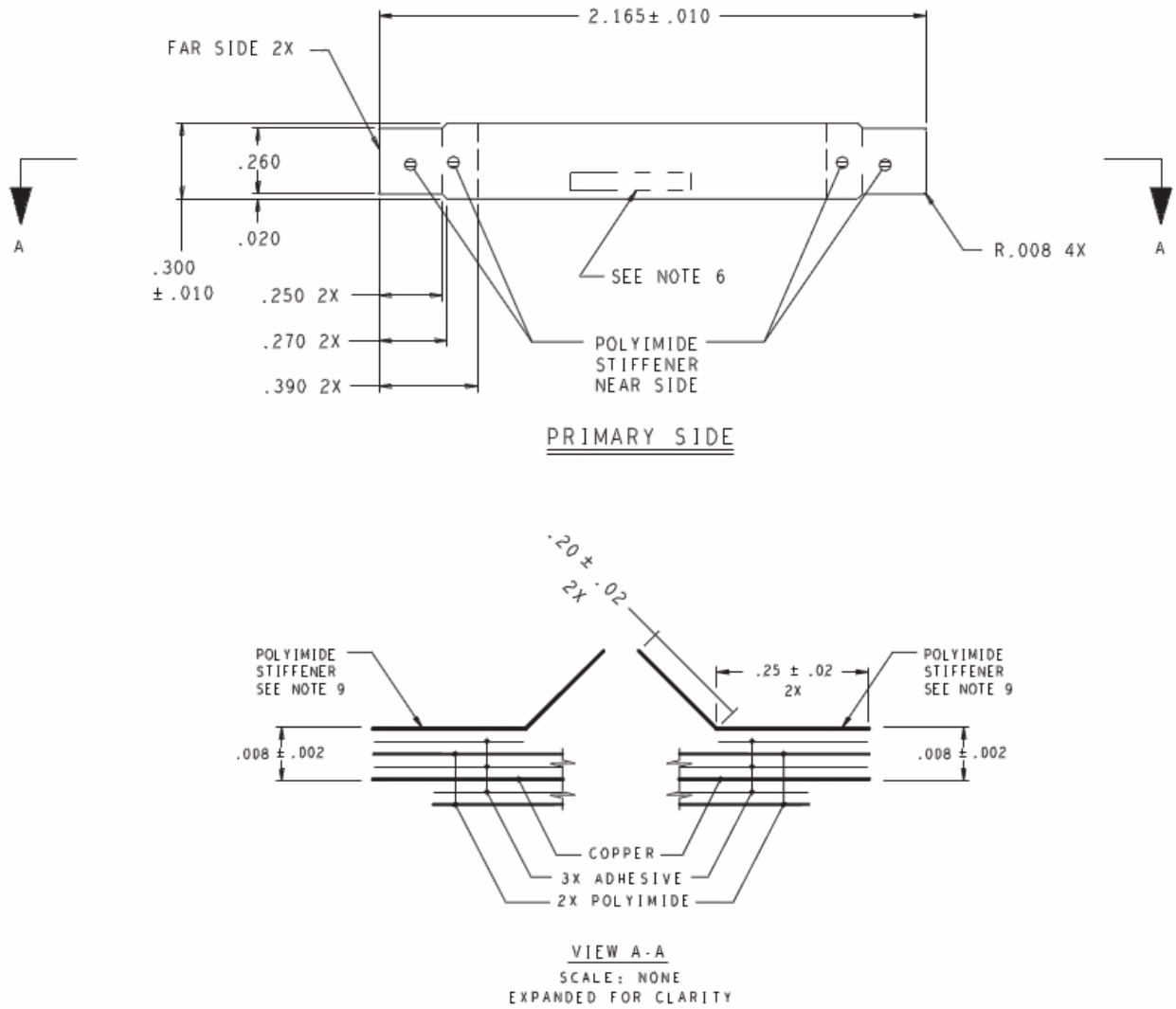


Figure 4-5 SE3300 to PL33XX Decoder 21-Pin Flex

CHAPTER 5 CONTROL INTERFACE

Introduction

The SE3300 bi-directional control interface uses the industry-standard I²C protocol. The SE3300 protocol is a host-initiated command/response type protocol, and does not support unsolicited responses.

Command List

The SE3300 protocol supports the commands listed in [Table 5-1](#). For detail on each command, see [Command Descriptions on page 5-5](#).

Table 5-1 SE3300 Command List

I ² C Command Set	Opcode	Description
ACQUISITION	0x58	Starts and stops image data output.
ACQUISITION_MODE	0x5B	Optimizes the SE3300 for a specific operation.
AIM	0x55	Turns the aim pattern on and off.
AIM_BLINK_RATE	0xF4	Controls the blink rate of the aim pattern.
AIM_DURING_EXPOSURE	0x56	Captures the aim pattern in the image.
AIM_POWER	0xF3	Controls the brightness of the aim pattern.
AUTO_POWER_REDUCTION	0x74	Places the SE3300 in a low power state when idle.
ENTER_BOOTLOADER	0x91	Enters bootloader mode.
EXEC_INLINE	0x83	Executes a programmed script.
EXECUTE_SCRIPT	0x77	Executes a programmed script.
EXTERNAL_ILLUMINATION	0x5A	Controls the operation of the EXT_ILLUM_EN signal.
FRAME_RATE	0x5E	Sets the SE3300 frame rate.
GET_FSTATS	0x81	Gets information about the last captured frame.

Table 5-1 SE3300 Command List (Continued)

I ² C Command Set	Opcode	Description
GET_PARAM	0x70	Gets SE3300 parameters.
ILLUMINATION_DURING_EXPOSURE	0x59	Turns illumination on and off.
IMAGE_CAPTURE_MODE	0x73	Sets the image capture mode.
IMAGE_CROPPING	0x5D	Crops the output image.
IMAGE_RESOLUTION	0x5C	Sets the resolution of the output image.
LCD_MODE	0x82	Enables and disables LCD mode.
PING	0x7A	Used for test purposes.
POWER_MODE	0x5F	Places the SE3300 in low power mode.
RD_OSC	0x53	Reads the oscillator registers.
RD_SENSOR	0x51	Reads the Micron MT9V022 registers.
RESET	0x57	Returns engine components to a default state.
TIME_TO_LOW_POWER	0x75	Sets the length of time the SE3300 is idle before entering low power mode.
WR_OSC	0x52	Writes to the oscillator registers.
WR_SCRIPT	0x76	Programs more than one SE3300 command into one script.
WR_SENSOR	0x50	Writes to the Micron MT9V022 registers.

Transactions

I²C transactions control the SE3300, where a transaction consists of a command followed by a response. I²C is a master/slave protocol, meaning the host initiates both transmissions.

The SE3300 typically processes a command in less than 1 ms, but some commands take up to 100 ms. For this reason, after sending a command, the host (I²C master) should request a response, and if the SE3300 does not respond the host should retry the response request for up to 100 ms. If the SE3300 does not respond within this time, a hard failure occurred.

The I²C format of these commands and responses is as follows.

I²C Command Format

<I2C-Start Bit> <SLA-W> <Cmd-Opcode> <[SE3300-Cmd-Data]> <Checksum> <I2C-Stop-Bit>

where:

- *I2C-Start-Bit* and *I2C-Stop-Bit* are as defined by the I²C specification
- *SLA-W* is 0xB8 (Slave-Addr + Write-Op) or
 - Slave Address is 0x5C (or 0xB8 after shifting into 7 MSBs)
 - Write-Op is 0x00
- *Opcode* is 1 byte from the *SE3300 Command Op* column in [Table 5-3 on page 5-10](#).
- *[SE3300-Cmd-Data]* is from the *SE3300 Command Data* column in [Table 5-3 on page 5-10](#). This can be NULL.
- *Checksum* is a 1 byte checksum of the *SE3300 Cmd Data* bytes. See [Command Checksum on page 5-4](#).

I²C Response Format

<I2C-Start Bit> <SLA-R> <Rsp-Opcode> <Status> <[SE3300-Rsp-Data]> <I2C-Stop-Bit>

Where:

- *I2C-Start-Bit* and *I2C-Stop-Bit* are as defined by the I²C specification
- *SLA-R* is 0xB9 (Slave-Addr + Read-Op) or
 - Slave Address is 0x5C (or 0xB8 after shifting into 7 msb's)
 - Read-Op is 0x01
- *Opcode* is 1 byte from the *SE3300 Response Op* column in [Table 5-3 on page 5-10](#).
- *Status* indicates whether the SE3300 successfully processed the command. See [Response Status Code on page 5-4](#).
- *[SE3300-Rsp-Data]* is from the *SE3300 Response Data* column in [Table 5-3 on page 5-10](#). This can be NULL.

Command Checksum

Every command must include a checksum, calculated as follows:

1. Sum the bytes in the command, starting from the opcode through the last command data byte.
2. Use only the low byte of this result.
3. Perform a 2's complement of this result.

This value is the checksum and is added to the checksum field of the command.

Response Status Code

Every response includes a status code that indicates the success of the command. A successful command returns an ACK or 0x80.

Table 5-2 lists status codes for single errors. Note that these error codes are bit positions within the status byte, and two errors can occur (e.g., NAK and INTERNAL_I2C_FAILURE), resulting in values not listed in this table.

Table 5-2 *Response Status Codes*

Status	Value	Cause / Meaning
ACK	0x80	Command was successful.
NAK	0x82 (Bit 1 set)	Command failed. Possible causes are: <ul style="list-style-type: none"> • Invalid opcode • Invalid command format • Invalid parameter value
CKSM_ERR	0x84 (Bit 2 set)	The transmitted checksum did not match the checksum of the data.
INTERNAL_I2C_FAILURE	0xA0 (Bit 5 set)	The internal I ² C interface failed.

Command Descriptions

See [Table 5-3 on page 5-10](#) for command and response formats for all SE3300 commands.

ACQUISITION 0x58

ACQUISITION Start causes the SE3300 to output image data on the camera interface. ACQUISITION Stop stops the image data output.

After receiving the Stop command, the SE3300 may not respond to subsequent commands for up to one frame time (16.6 ms at 60 fps) because the system requires the current frame to complete before the engine processes new commands. Issuing commands during this time results in unacknowledged I²C commands, requiring command retries.

ACQUISITION_MODE 0x5B

Optimizes the engine's behavior for bar code decoding, image capture, motion detection, or aiming pattern capture.

AIM 0x55

Turns the aiming pattern on and off. AIM only turns aiming on if acquisition is started. Setting AIM On while acquisition is stopped does not turn aiming on, although it turns aiming on upon the next ACQUISITION Start command.

AIM_BLINK_RATE 0xF4

Controls the blink rate of the aiming pattern. The aiming pattern only blinks when AIM is enabled. The default is Always On.

This command takes two parameters:

- Byte 1 = Number of frames the aiming pattern remains on; 0 = Always On
- Byte 2 = Number of frames the aiming pattern is off.

Blink rate/times depend on the frame rate, for example:

- At 60 fps, to blink at 1/3 seconds on and 2/3 seconds off, set Byte 1 to 20 and Byte 2 to 40.
- At 30 fps, to blink at 1/3 seconds on and 2/3 seconds off, set Byte 1 to 10 and Byte 2 to 20.

✓ **NOTE** When using Picklist Mode, AIM_BLINK_RATE must remain at its default.

AIM_DURING_EXPOSURE 0x56

When enabled, this keeps the aiming pattern on when capturing an image, meaning the pattern is visible in the image. When disabled, the aiming pattern is not visible in acquired images. The default is disabled.

Enabling AIM_DURING_EXPOSURE has no effect unless AIM is also on. Enabling AIM_DURING_EXPOSURE while acquisition is stopped does not turn aiming on, although it turns aiming on upon the next ACQUISITION Start command.

AIM_POWER 0xF3

Controls the brightness of the aiming pattern. The default is 0x0 or Always On.

A value of 0x0 indicates that exposure and readout times control the aim's duration (and power or brightness).

Values of 0x1 - 0xFF indicate the aiming duration increments from 0.5 ms upward in 0.5 ms intervals; however, exposure and readout times clip its maximum value.

AUTO_POWER_REDUCTION 0x74

Places the SE3300 in a low power state when idle for the duration of time specified by the TIME_TO_LOW_POWER command. Any I²C command wakes the SE3300 from low power mode.

The SE3300 is considered idle only if acquisition is stopped. While acquisition is started, the SE3300 does not automatically enter low power mode.

ENTER_BOOTLOADER 0x91

Enters bootloader mode, which changes the SE3300 protocol so that it no longer supports this command set. Bootloader mode is required for firmware update.

EXEC_INLINE 0x83

Executes more than one command inline without first writing it to the engine. This is helpful for scripts that don't require executing more than once.

Example

To execute inline with Aim On, Illumination On, and Acquisition On the command is:

```
<0x83><0x00><Len><C1Len><C1Op><C1Data><C2Len><C2Op><C2Data>  
<C3Len><C3Op><C3Data><CS>
```

or

```
<0x83><0x00><0x09><0x02><0x55><0x01><0x02><0x59><0x01><0x02><0x58><0x01><0x70>
```

EXECUTE_SCRIPT 0x77

After programming a script (via the WR_SCRIPT command), use this command to execute it.

EXTERNAL_ILLUMINATION 0x5A

Controls operation of the EXT_ILLUM_EN signal on the SE3300 host connector.

FRAME_RATE 0x5E

Sets the SE3300 frame rate.

GET_FSTATS 0x81

Returns a response containing information about the last captured frame, including the exposure, gain, and BIN values used as well as the statistics. The statistics byte is defined as follows:

- Illumination On = 0x01
- AIM On = 0x02
- Picklist Frame = 0x10
- LCD Frame = 0x20

GET_PARAM 0x70

Allows a host to read out parameters stored in the SE3300 (non-volatile memory). See [Table 5-4 on page 5-13](#) for a list of these parameters.

ILLUMINATION_DURING_EXPOSURE 0x59

Turns Illumination on and off. Illumination only turns on if acquisition is started. Enabling illumination while acquisition is stopped does not turn illumination on, although it turns on illumination upon the next ACQUISITION Start command.

IMAGE_CAPTURE_MODE 0x73

Sets image capture mode to one of the following:

- Continuous (0x00) - an ACQUISITION Start command results in continuous image frames (one right after another) until you issue the ACQUISITION Stop command.
- Snapshot (0x01) - an ACQUISITION Start command results in only one image frame. Issue another ACQUISITION Start command to acquire another image/frame.

The default is Continuous.

IMAGE_CROPPING 0x5D

Crops the output image to the specified pixel edge.

IMAGE_RESOLUTION 0x5C

Sets the resolution of the output image. Row Bin 2 and Column Bin 2 halve the number of rows and columns, respectively, in the image. Row Bin 4 and Column Bin 4 cut the number of rows and columns by a factor of 4.

This command is cumulative, i.e., to set Row Bin 2 and Column Bin 2, use the two-command sequence:

```
<0x5C> <0x01> <Checksum> <0x5C> <0x03> <Checksum>
```

To return to Normal, use the single command:

```
<0x5C> <0x00> <Checksum>
```

LCD_MODE 0x82

Enables and disables LCD mode. This command has two parameters:

- Number of No-light Frames (LCD frames)
- Total Number of Frames

Setting the Number of No-light Frames to 0 disables LCD mode. Setting the Number of No-light Frames to 1 enables LCD mode. The Total Number of Frames field is ignored.

This command works in conjunction with ACQUISITION Start. Configure LCD_MODE before starting acquisition. When acquisition starts, the LCD mode sequence begins. Disable LCD mode (by setting the number of LCD frames to 0) before stopping acquisition. To track cell phone frames issue the GET_FSTATS command after every frame. The statistics byte specifies whether the frame was the LCD frame.

PING 0x7A

Use this command for test purposes to verify that the engine is in a powered state.

POWER_MODE 0x5F

Changes the SE3300's power mode. Although this command offers a Full Power mode option, any command returns the SE3300 to full power mode.



NOTE This command is rejected (a NAK is sent) if acquisition is running (ACQUISITION = Start). If low power is required during acquisition, first send ACQUISITION = Stop, then POWER_MODE = Low Power.

RD_OSC 0x53

Reads oscillator registers. Refer to the DS1086L oscillator specification from Maxim (<http://www.maxim-ic.com>) for register descriptions.

RD_SENSOR 0x51

Reads Micron MT9V022 sensor registers. Refer to the MT9V022 specification from Micron for register descriptions.

This command is used to read the SE3300 internal temperature. The values reported have no units (cannot be converted into Celsius or Fahrenheit) and are inverted (higher values indicate lower temperatures).

RESET 0x57

Returns the SE3300 to a default state.

TIME_TO_LOW_POWER 0x75

Sets the length of time the SE3300 must be idle before it enters low power mode. This only applies if AUTO_POWER_REDUCTION is enabled.

WR_OSC 0x52

Writes directly to the oscillator IC registers. Refer to the DS1086L oscillator specification from Maxim (<http://www.maxim-ic.com>) for register descriptions.

Note that the SE3300 controls many oscillator registers. Using this command to write registers may conflict with SE3300 requirements, causing unpredictable behavior.

WR_SCRIPT 0x76

Programs more than one SE3300 command into a script, which can be executed using a single command (EXECUTE_SCRIPT). Use this method whenever possible to increase performance and timing synchronization.

There are ten scripts (Script-0 through Script-9) and a total of 150 bytes for all scripts. Exceeding these limits results in a NAK status code. The general format for this command is:

```
<0x76><Script#><Len> [ <C1Len><C1Op><C1Data> ] [ <C2Len><C2Op><C2Data> ]
[ <C3Len><C3Op><C3Data> ] <Checksum>
```

✓ **NOTE** Brackets ([]) appear in this example for clarity only, and are not part of the commands.

Example

To program script 2 with AIM_ON, ILLUM_ON, and ACQUISITION_ON, format the WR_SCRIPT command as follows:

```
<0x76><0x02><0x09> [ <0x02><0x55><0x01> ] [ <0x02><0x59><0x01> ] [ <0x02><0x58><0x01> ]
<0x70>
```

WR_SENSOR 0x50

Writes directly to the Micron MT9V022 sensor registers. Refer to the MT9V022 specification from Micron for register descriptions.

Note that the SE3300 controls many sensor registers. Using this command to write sensor registers may conflict with SE3300 requirements, causing unpredictable behavior.

Command / Response Formats

Table 5-3 depicts the command and response formats for all SE3300 commands.

In the columns *SE3300 Command Data* and *SE3300 Response Data*, the following letters identify the size of the data: (B) = Byte, (W) = Word, or (A) = Array. Words are in Little-Endian format (low byte first).

* indicates the default.

Table 5-3 SE3300 Command and Response Formats

Function	SE3300 Command		SE3300 Response	
	Op	SE3300 Command Data ^{Note1}	Op	SE3300 Response Data ^{Note2}
WR_SENSOR	0x50	(B) Register (W) Value	0x50	-
RD_SENSOR	0x51	(B) Register	0x51	(W) Value
WR_OSC	0x52	(B) Register (W) Value	0x52	-
RD_OSC	0x53	(B) Register	0x53	(W) Value
AIM	0x55	(B) 0x00=Off* 0x01=On	0x55	-
AIM_DURING_EXPOSURE	0x56	(B) 0x00=Off* 0x01=On	0x56	-
RESET	0x57	(B) 0x00=Sensor 0x01=SE3300	0x57	-
ACQUISITION	0x58	(B) 0x00=Stop 0x01=Start	0x58	-
ILLUMINATION_DURING_EXPOSURE	0x59	(B) 0x00=Off* 0x01=On	0x59	-
EXTERNAL_ILLUMINATION	0x5A	(B) 0x00=Floating Input* 0x01=On 0x02=Off 0x03=Follow Internal Illumination 0x04=Follow Trigger 0x05=Alternate with Internal Illumination	0x5A	-
ACQUISITION_MODE	0x5B	(B) 0x00=Barcode Decode* 0x01=Document Capture 0x02=Motion Detect 0x03=Aim Capture	0x5B	-

Notes:

1. Every command has a 1 byte checksum (last byte of command). See *Command Checksum* on page 5-4.
2. Every response has a 1 byte status code immediately following the Opcode. See *Response Status Code* on page 5-4.
3. These commands/responses have a variable length data field indicated by (A):Array. See *Table 5-4* on page 5-13 for the length of the field based on the param number.

Table 5-3 SE3300 Command and Response Formats (Continued)

Function	SE3300 Command		SE3300 Response		
	Op	SE3300 Command Data ^{Note1}	Op	SE3300 Response Data ^{Note2}	
IMAGE_RESOLUTION	0x5C	(B) 0x00=Normal* 0x01=Row Bin 2 0x02=Row Bin 4 0x03=Column Bin 2 0x04=Column Bin 4	0x5C	-	
IMAGE_CROPPING	0x5D	(B) Edge 0x00=Top 0x01=Right 0x02=Bottom 0x03=Left	(W) Value (No. of pixels to crop)	0x5D	-
FRAME_RATE	0x5E	(B) 0x00=60fps* 0x01=30fps 0x02=15fps 0x03=10fps	0x5E	-	
POWER_MODE	0x5F	(B) 0x00=Full* 0x01=Low	0x5F	-	
GET_PARAM (see Note 3 and Table 5-4)	0x70	(W) Param#	0x70	(W) Param#	(A) Param Data (Note 3)
IMAGE_CAPTURE_MODE	0x73	(B) 0x00 = Continuous 0x01 = Snapshot	0x73	-	
AUTO_POWER_REDUCTION	0x74	(B) 0x00=Disabled 0x01=Enabled	0x74	-	
TIME_TO_LOW_POWER	0x75	(B) 0x01* - 0x0A = 10-100 ms, 10 ms increments 0x0B - 0x14 = 100-900 ms, 100 ms increments 0x15 - 0xFF = 1s - 235 s, 1 s increments 0x00 = 5 ms	0x75	-	
WR_SCRIPT (Note 3)	0x76	(B) Script#	(A) Script Data	0x76	-
EXECUTE_SCRIPT	0x77	(B) Script#		0x77	-
PING	0x7A	-		0x7A	

Notes:

1. Every command has a 1 byte checksum (last byte of command). See *Command Checksum on page 5-4*.
2. Every response has a 1 byte status code immediately following the Opcode. See *Response Status Code on page 5-4*.
3. These commands/responses have a variable length data field indicated by (A):Array. See *Table 5-4 on page 5-13* for the length of the field based on the param number.

Table 5-3 SE3300 Command and Response Formats (Continued)

Function	SE3300 Command			SE3300 Response		
	Op	SE3300 Command Data ^{Note1}		Op	SE3300 Response Data ^{Note2}	
GET_FSTATS	0x81			0x81	Returns 5 Bytes as follows: (W) Exposure (B) Gain (B) BIN (B) Statistics	
LCD_MODE	0x82	(B) # No-light Frames	(B) # Frames	0x82		
EXEC_INLINE	0x83	(B) Reserved	(A) Script Data	0x83		
ENTER_BOOTLOADER	0x91	(A) Signature (3 bytes: 0xAA, 0x50, 0x5F)		0x91		
AIM_POWER	0xF3	(B) 0x00* = Aim's duration is controlled by Exposure and Readout times. 0x01-0xFF = Aim's duration increments from 0.5 ms in 0.5 ms duration, its maximum value controlled by Exposure and Readout time.		0xF3	-	
AIM_BLINK_RATE	0xF4	(B) On Time in ~17ms increments	(B) Off Time in ~17ms increments	0xF4	-	

Notes:

1. Every command has a 1 byte checksum (last byte of command). See *Command Checksum* on page 5-4.
2. Every response has a 1 byte status code immediately following the Opcode. See *Response Status Code* on page 5-4.
3. These commands/responses have a variable length data field indicated by (A):Array. See *Table 5-4* on page 5-13 for the length of the field based on the param number.

Table 5-4 SE3300 Parameter Numbers and Data Formats

Parameter	Description	Number	Length (bytes)
MODEL_NUMBER	Engine model number	0	18
SERIAL_NUMBER	Engine serial number	1	16
DATE_MANUFACTURE	Engine manufacturing date	2	7
DATE_SERVICE	Engine service date	3	7
SCANNER_BOOTLOADER_FIRMWARE_VERSION	Engine bootloader version	10	8
SCANNER_PRODUCTCODE_FIRMWARE_VERSION	Engine firmware version	20004	8
ENGINE_ID	Engine ID number	20005	1
HARDWARE_VERSION	Engine hardware version	20006	1
DEVICE_CLASS	Engine device class.	20007	18
GUID	Generally Unique ID	14	32

CHAPTER 6 APPLICATION NOTES

Introduction

This chapter includes image acquisition and power consumption information. LED illumination is required for decoding.

Image Acquisition

The SE3300 contains a wide VGA CMOS sensor. [Figure 6-1](#) and [Figure 6-2](#) illustrate pixel output format, and [Figure 6-3](#) and [Figure 6-4](#) show basic timing information.

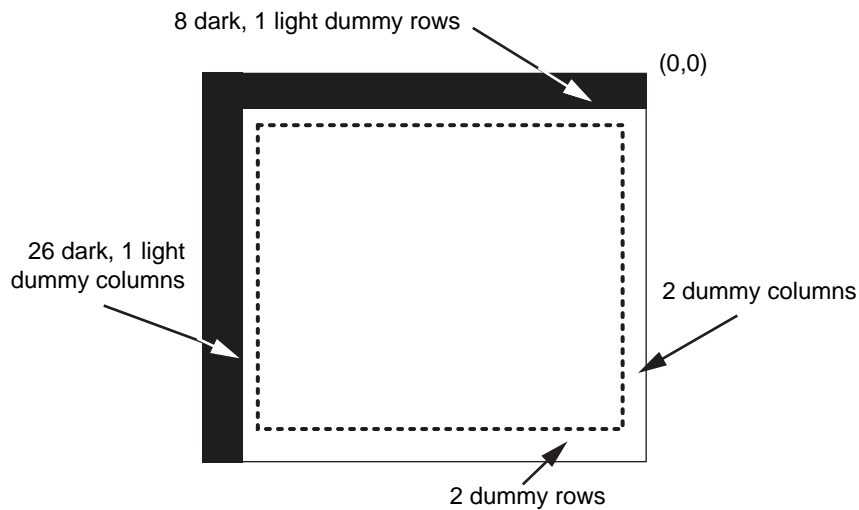


Figure 6-1 Pixel Output Format

Output Data Format

Image data can be read out in a progressive scan or in interlaced scan mode. Vertical and horizontal blanking surrounds valid image data, as shown in *Figure 6-2*.

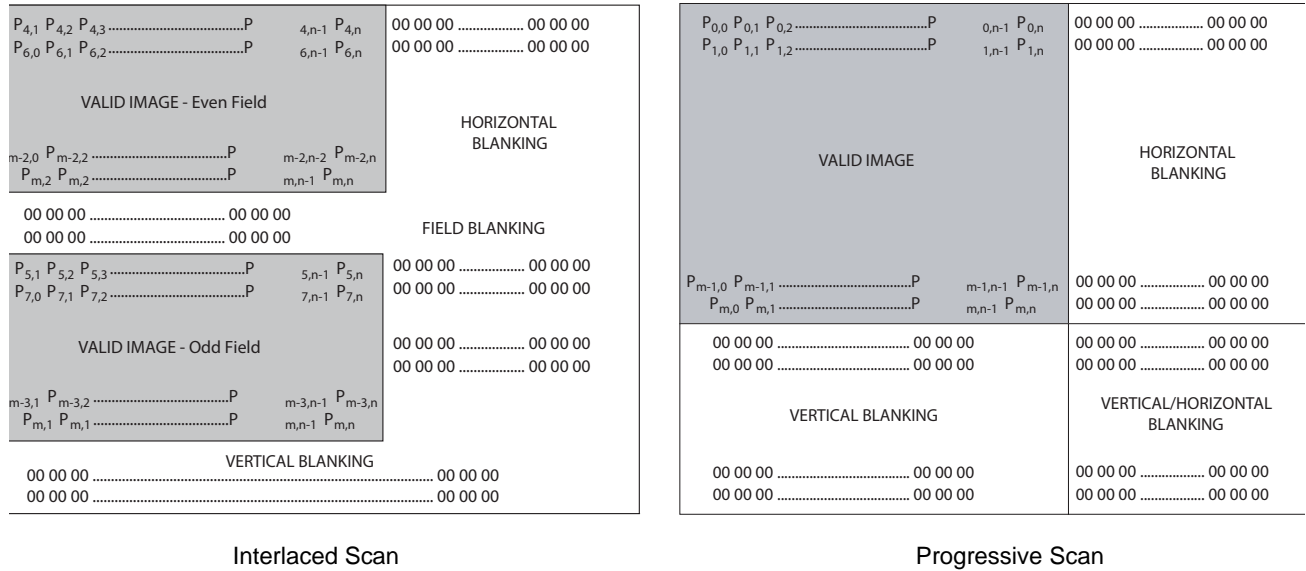


Figure 6-2 Image Readout

Output Data Timing

Data output is synchronized with the PIXCLK output. When LINE_VALID is high, one 10-bit pixel datum is output every PIXCLK period.

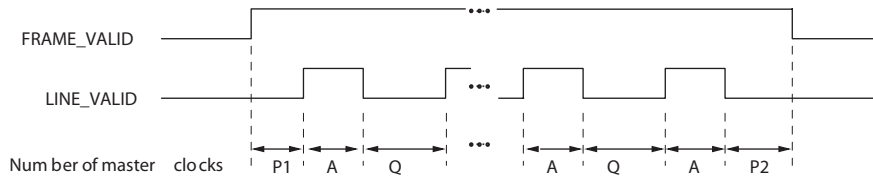


Figure 6-3 Row Timing and FRAME_VALID / LINE_VALID Signals

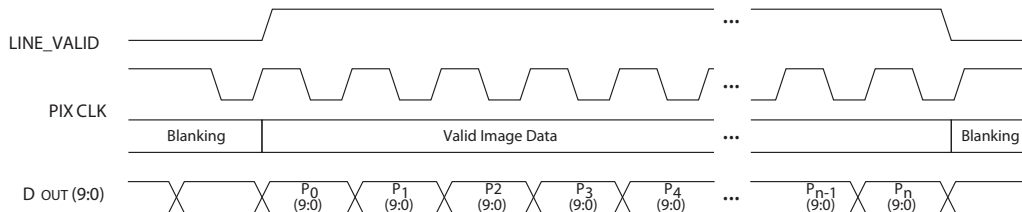


Figure 6-4 Pixel Data Timing Example

Table 6-1 *Frame Time*

Parameter	Description	Pixel Clock	Master Clocks	Time	Units
A	Active data time	752	752	28.02	μs
P1	Frame start blanking	71	71	2.66	μs
P2	Frame end blanking	23	23	0.86	μs
Q	Horizontal blanking	94	94	3.52	μs
A + Q	Row time	846	846	31.72	μs
V	Vertical blanking	38,074	38,074	1.43	ms
Nrows	Frame valid time	406,080	406,080	15.23	ms
F	Total frame time	444,154	444,154	16.66	ms

Recommended Procedures

The following trigger mode procedures describe the recommended transaction sequence between a host and the SE3300. These transaction sequences use discrete commands for clarity. Replace any set of discrete commands with a multi-command EXECUTE_SCRIPT to improve throughput.

Normal Decode Mode

Level Trigger Mode Procedure

The system is initialized as follows:

- The host sends the Aim Off command.
- The host sends the Illumination Off command.
- The host sends the Acquisition Stop command.
- The host sends the Barcode Decode mode command.
- The SE3300 optimizes the image output for bar code decoding.
- The SE3300 enters standby mode (or low power mode if enabled).

Upon a trigger pull:

- The host sends the Illumination On command.
- The SE3300 exits standby mode (or low power mode if enabled).
- The host sends the Aim On command.
- The host sends the Acquisition Start command.
- The SE3300 begins outputting images.
- The host attempts to decode the images.

Upon a good decode or trigger release:

- The host sends the Acquisition Stop command.
- The SE3300 stops outputting images.
- The host sends the Aim Off command.
- The host sends the Illumination Off command.
- The SE3300 enters standby mode (or low power mode if enabled).

Picklist in Level Trigger Mode Procedure

The system is initialized as follows:

- The host sends the Aim Off command.
- The host sends the Illumination Off command.
- The host sends the Acquisition Stop command.
- The host sends the Barcode Decode mode command.
- The host sends the Picklist Mode(1,60) command
- The SE3300 optimizes the image output for bar code decoding.
- The SE3300 enters standby mode (or low power mode if enabled).

Upon a trigger pull:

- The host sends the Illumination On command.
- The SE3300 exits standby mode (or low power mode if enabled).
- The host sends the Aim On command.
- The host sends the Acquisition Start command.
- The SE3300 begins outputting images. Starting with the first frame, every 60th frame is a picklist frame (1,61,121,181 ...).
- The host attempts to decode the images.

Upon a good decode or trigger release:

- The host sends the Acquisition Stop command.
- The SE3300 stops outputting images.
- The host sends the Aim Off command.
- The host sends the Illumination Off command.
- The SE3300 enters standby mode (or low power mode if enabled).

Presentation Mode Procedure

The system is initialized as follows:

- The host sends the Aim Off command.
- The host sends the Illumination On command.
- The host sends the Illumination Power Off command (Off is the default, but power can be set low to allow motion detection in darkness).
- The host sends the Acquisition Start command (and never sends the Stop command).
- The host sends the Motion Detect mode command.
- The SE3300 optimizes the image output for motion detection.
- The SE3300 continuously outputs images.
- In this mode, the SE3300 does not enter standby or low power mode.

Upon the host detecting motion:

- The host sends the Aim On command.
- The host sends the Illumination Power Full command.
- The host sends the Barcode Decode mode command.
- The SE3300 optimizes the image output for bar code decoding.
- The host attempts to decode the images.

Upon a good decode:

- The host sends the Aim Off command.
- The host sends the Illumination Power Off command (Off is the default, but power can be set low to allow motion detection in darkness).
- The host sends the Motion Detect mode command.
- The SE3300 optimizes the image output for motion detection.

During this mode:

- The SE3300 does not automatically enter standby or low power mode.
- The host uses the Power Mode command to put the SE3300 into a low power mode (for support of Bus Powered USB).

Auto-AIM Mode Procedure

The system is initialized as follows:

- The host sends the Illumination Off command.
- The host sends the Aim On command.
- The host sends the Motion Detect mode command.
- The host sends the Acquisition Start command (and never sends the Stop command).
- The host sends the Aim Off command.
- The SE3300 optimizes the image output for motion detection.
- The SE3300 continuously outputs images

Upon the host detecting motion:

- The host sends the Barcode Decode mode command.
- The host sends the Aim On command.

Upon a trigger pull:

- The host sends the Illumination On command.
- The SE3300 optimizes the image output for bar code decoding.
- The host attempts to decode the images.

Upon a good decode or trigger release:

- The host sends the Aim Off command.
- The host sends the Illumination Off command.
- The host sends the Motion Detect mode command.
- The SE3300 optimizes the image output for motion detection.

During this mode:

- The SE3300 does not automatically enter low power mode.
- The host uses the Power Mode command to put the SE3300 into a low power mode (for support of Bus Powered USB).

Picklist in Auto-AIM Mode Procedure

The system is initialized as follows:

- The host sends the Illumination Off command.
- The host sends the Aim On command.
- The host sends the Motion Detect mode command.
- The host sends the Picklist Mode(1,60) command
- The host sends the Acquisition Start command (and never sends the Stop command).
- The host sends the Aim Off command.
- The SE3300 optimizes the image output for motion detection.
- The SE3300 continuously outputs images. Starting with the first frame, every 60th frame is a picklist frame (1,61,121,181 ...).

Upon the host detecting motion:

- The host sends the Barcode Decode mode command.
- The host sends the Aim On command.

Upon a trigger pull:

- The host sends the Illumination On command.
- The SE3300 optimizes the image output for bar code decoding.
- The host attempts to decode the images.

Upon a good decode or trigger release:

- The host sends the Aim Off command.
- The host sends the Illumination Off command.
- The host sends the Motion Detect mode command.
- The SE3300 optimizes the image output for motion detection.

During this mode:

- The SE3300 does not automatically enter low power mode.
- The host uses the Power Mode command to put the SE3300 into a low power mode (for support of Bus Powered USB).

Snapshot Mode

Level/Presentation/Auto-Aim Trigger Mode Procedure

The system is initialized as follows:

- The host sends the Aim Off command.
- The host sends the Illumination Off command.
- The host sends the Acquisition Stop command.
- The host sends the Imaging mode command.
- The SE3300 optimizes the image output for image capture.
- The SE3300 (typically) enters low power mode.

Upon a trigger pull:

- The host sends the Illumination On command.
- The SE3300, if in low power mode, exits low power mode (either Reduced or Sleep).
- The host sends the Aim On command.
- The host sends the Acquisition Start command.
- The SE3300 captures an image.

Upon completion of an image capture:

- The SE3300 stops outputting image.
- The host sends the Acquisition Stop command.
- The host sends the Aim Off command.
- The host sends the Illumination Off command.
- The host goes back to Normal Decode Mode.
- The SE3300 (when all conditions are met) enters Reduced Power mode.

Recommendations

Power Mode

The SE3300 powers up into full power mode. To save power, enable `AUTO_POWER_REDUCTION`.

Scripts

For improved performance and timing synchronization, replace a set of discrete commands with a multi-command `EXECUTE-SCRIPT`.

APPENDIX A REGISTER SETTINGS

For information on register settings for the engine, refer to the *Aptina MT9V022 (mono) Wide VGA CMOS Digital Image Sensor Datasheet*, available at <http://www.aptna.com>.

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72E-148589-01 Revision .8 - September 2011

