

**Viking eUSB**

**Embedded USB Datasheet**

~

**Industrial Products**

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 1 of 19

## Revision History

Date	Revision	Description
A	11/13/2008	Initial release; replace PSFDUC3XXXXRCX to include industrial temp support.
B	1/30/2009	Corrections to MO
C	2/18/2009	Change length to max value
D	12/8/2009	Corrected mechanical dimensions (board thickness). Added AC timing requirements for power-up. Added note for 3.3V BOM.
D1	5/25/2009	Updated device for 32GB module
D2	9/24/2010	Updated document format. Added power consumption table, reliability information
D3	11/15/2011	Updated physical dimensions. Added new company logo and name. Removed references to single channel. Added 3.3V PN and related technical information.
D4	12/7/2011	Corrected notes at MTBF table and power consumption table.
D5	1/9/2012	Revised PN Table.
D6	2/5/2013	Add VRFDUC3(L)032GRCN3 and VRFDUC3(L)032GRCN PN using higher density die in a DDP
D7	2/25/2013	Add PN's and mechanical dimensions for version-2 eUSB based on PCB's 1448 and 1449. removed export control restriction.
E	5/23/2013	Add LBA table. Revise notes on PN table. Added clarification to table heading

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 2 of 19

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Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 3 of 19

## Ordering Information: eUSB Family

Viking High Performance USB embedded Drive Ordering Information

Part Number Version-1 ( four flash placements)	Capacity	Device Density	Voltage	# Devices	Channels	LBA
VRFDUC3(L)0256Rx6yy	256MB	1Gb	5	2	2	521,265
VRFDUC3(L)0256Rx9yy	256MB	2Gb	5	1	1	521,265
VRFDUC3(L)0512Rx7yy	512MB	4Gb	5	1	1	1,021,362
VRFDUC3(L)1024Rx7yy	1GB	4Gb	5	2	2	1,974,672
VRFDUC3(L)1024RxGyy	1GB	8Gb	5	1	1	1,974,672
VRFDUC3(L)2048Rx7yy	2GB	4Gb	5	4	2	3,928,176
VRFDUC3(L)2048RxGyy	2GB	8Gb	5	2	2	3,928,176
VRFDUC3(L)2048RxHyy	2GB	16Gb	5	1	1	3,928,176
VRFDUC3(L)4096RxHyy	4GB	16Gb	5	2	2	7,835,184
VRFDUC3(L)4096RxKyy	4GB	32Gb	5	1	1	7,835,184
VRFDUC3(L)8192RxHyy	8GB	16Gb	5	4	2	15,649,200
VRFDUC3(L)8192RxKyy	8GB	32Gb	5	2	2	15,649,200
VRFDUC3(L)8192RxMyy	8GB	64Gb	5	1	1	15,649,200
VRFDUC3(L)016GRxKyy	16GB	32Gb	5	4	2	31,277,232
VRFDUC3(L)016GRxMyy	16GB	64Gb	5	2	2	31,277,232
VRFDUC3(L)032GRxRyy	32GB	64Gb	5	4	2	62,533,296
VRFDUC3(L)0256Rx63yy	256MB	1Gb	3.3	2	2	521,265
VRFDUC3(L)0256Rx93yy	256MB	2Gb	3.3	1	1	521,265
VRFDUC3(L)0512Rx73yy	512MB	4Gb	3.3	1	1	1,021,362
VRFDUC3(L)1024Rx93yy	1GB	2Gb	3.3	4	2	1,974,672
VRFDUC3(L)1024Rx73yy	1GB	4Gb	3.3	2	2	1,974,672
VRFDUC3(L)1024RxG3yy	1GB	8Gb	3.3	1	1	1,974,672
VRFDUC3(L)2048Rx73yy	2GB	4Gb	3.3	4	2	3,928,176
VRFDUC3(L)2048RxG3yy	2GB	8Gb	3.3	2	2	3,928,176
VRFDUC3(L)2048RxH3yy	2GB	16Gb	3.3	1	1	3,928,176
VRFDUC3(L)4096RxG3yy	4GB	8Gb	3.3	4	2	7,835,184
VRFDUC3(L)4096RxH3yy	4GB	16Gb	3.3	2	2	7,835,184
VRFDUC3(L)4096RxK3yy	4GB	32Gb	3.3	1	1	7,835,184
VRFDUC3(L)8192RxH3yy	8GB	16Gb	3.3	4	2	15,649,200
VRFDUC3(L)8192RxK3yy	8GB	32Gb	3.3	2	2	15,649,200
VRFDUC3(L)8192RxM3yy	8GB	64Gb	3.3	1	1	15,649,200

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 4 of 19

Part Number Version-1 ( four flash placements)	Capacity	Device Density	Voltage	# Devices	Channels	LBA
VRFDUC3(L)016GRxK3yy	16GB	32Gb	3.3	4	2	31,277,232
VRFDUC3(L)016GRxM3yy	16GB	64Gb	3.3	2	2	31,277,232
VRFDUC3(L)032GRxR3yy	32GB	64Gb	3.3	4	2	62,533,296

Part Number Version-2 ( two flash placements)	Capacity	Device Density	Voltage	# Devices	Channels	LBA
VRFDUC3(L)1024RxGyy	1GB	8Gb	5	1	1	1,974,672
VRFDUC3(L)2048RxGyy	2GB	8Gb	5	2	2	3,928,176
VRFDUC3(L)4096RxHyy	4GB	16Gb	5	2	2	7,835,184
VRFDUC3(L)8192RxKyy	8GB	32Gb	5	2	2	15,649,200

**Notes:**

1. DUC3xxxx signifies standard profile, DUC3Lxxxx signifies low profile.
2. x = C for Commercial temperature range: 0 to 70°C (32 to 158° F)  
or I for Industrial temperature range: -40 to 85°C (-40 to 185° F)
3. Storage capacity listed will vary due to formatting and additional functions,  
and therefore is not available for storage.
4. USB's ship formatted from the factory unless otherwise requested.
5. All eUSBs are based on SLC flash unless otherwise requested.
6. All capacities are available in 3.3V versions.
7. yy indicates BOM specific information
8. "L" indicate low profile
9. Maximum of 4KB per page

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 5 of 19

## Table of Contents

<b>1</b>	<b>INTRODUCTION</b>	<b>8</b>
1.1	Product Overview	8
1.2	Features	8
1.3	Block Diagram	9
1.4	USB Interface	10
<b>2</b>	<b>PRODUCT SPECIFICATIONS</b>	<b>10</b>
2.1	Performance	10
2.2	Timing	10
2.3	Power-up AC timing Requirements	10
2.4	<b>Electrical Characteristics</b>	<b>11</b>
2.4.1	Absolute Maximum Ratings	11
2.4.2	DC Operating Conditions and Characteristics	11
2.4.3	Power Consumption	12
2.4.4	Capacitance	12
2.5	<b>Environmental Conditions</b>	<b>12</b>
2.5.1	Temperature and Altitude	12
2.6	Reliability	13
<b>3</b>	<b>MECHANICAL INFORMATION</b>	<b>14</b>
<b>4</b>	<b>PIN AND SIGNAL DESCRIPTIONS</b>	<b>18</b>
4.1	Signal and Power Description Tables	18
<b>5</b>	<b>CERTIFICATIONS AND COMPLIANCE</b>	<b>19</b>
<b>6</b>	<b>REFERENCES</b>	<b>19</b>

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 6 of 19

## Table of Tables

<i>Table 2-1: Maximum Sustained Read and Write Bandwidth</i>	10
<i>Table 2-2: Timing Specifications</i>	10
<i>Table 2-3: Absolute Maximum Ratings</i>	11
<i>Table 2-4: Voltage and Current Ratings</i>	11
<i>Table 2-5: Power Consumption</i>	12
<i>Table 2-6: Bus Line Capacitance</i>	12
<i>Table 2-7: Temperature and Altitude Related Specifications</i>	12
<i>Table 2-8: Reliability Specifications</i>	13
<i>Table 4-1: eUSB Connector Pin Signal Definitions</i>	18
<i>Table 5-1: Device Certifications</i>	19

## Table of Figures

<i>Figure 1-1: High-Level Block Diagram</i>	9
<i>Figure 3-1: Location of PCB # marking</i>	14
<i>Figure 3-2: Dimensions (Version-1)</i>	15
<i>Figure 3-3: Dimensions (Version-2, low profile)</i>	16
<i>Figure 3-4: Dimensions (Version 2, standard profile)</i>	17
<i>Figure 4-1: Connector Pin Assignments</i>	18

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 7 of 19

# 1 Introduction

## 1.1 Product Overview

Viking Technology's Embedded USB (eUSB) module provides a rugged, reliable and cost effective non-volatile memory, solutions to OEM customers in the Communication, Networking, Embedded and Industrial markets. The eUSB module is a secure pluggable device and a drop-in replacement for Intel® Z-U130 Value Solid State Drive with a USB 2.0 interface, ECC and global wear-leveling. Additional options such as MLC (Multi Level Cell) technology and ESD protection are also available.

Viking's rugged industrial designed USB's offer the highest flash storage reliability and performance in harsh environments such as shock, vibration, humidity, altitude, ESD, and extreme temperatures. Viking USB's meet JEDEC JESD22 standards and pass numerous qualifications including MIL-STDs and NEBS.

Viking can also provide specialized services to OEMs designing customized hardware and systems by offering:

- Locked BOM control with customer product change notification (PCN)
- Pre-installed software, custom software imaging and ID strings
- Custom packaging and labeling
- Comprehensive supply-chain management
- Customer specified testing
- 30k volt ESD protection
- Conformal coating
- Localized Field Application Engineering for complete pre and post sale technical support

## 1.2 Features

The embedded USB drive delivers the following features:

- USB 2.0 high speed compatible (supports Bulk-Only transport protocol)\*
- Up to 35 MB/s Read Speed and 23 MB/s Write Speed (Dual Channel)
- Up to 23 MB/s Read Speed and 12 MB/s Write Speed (Single Channel)
- Host Interface Speed 60MB/s
- Drive Activity indicator signal
- Firmware upgradeable via USB bus

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 8 of 19

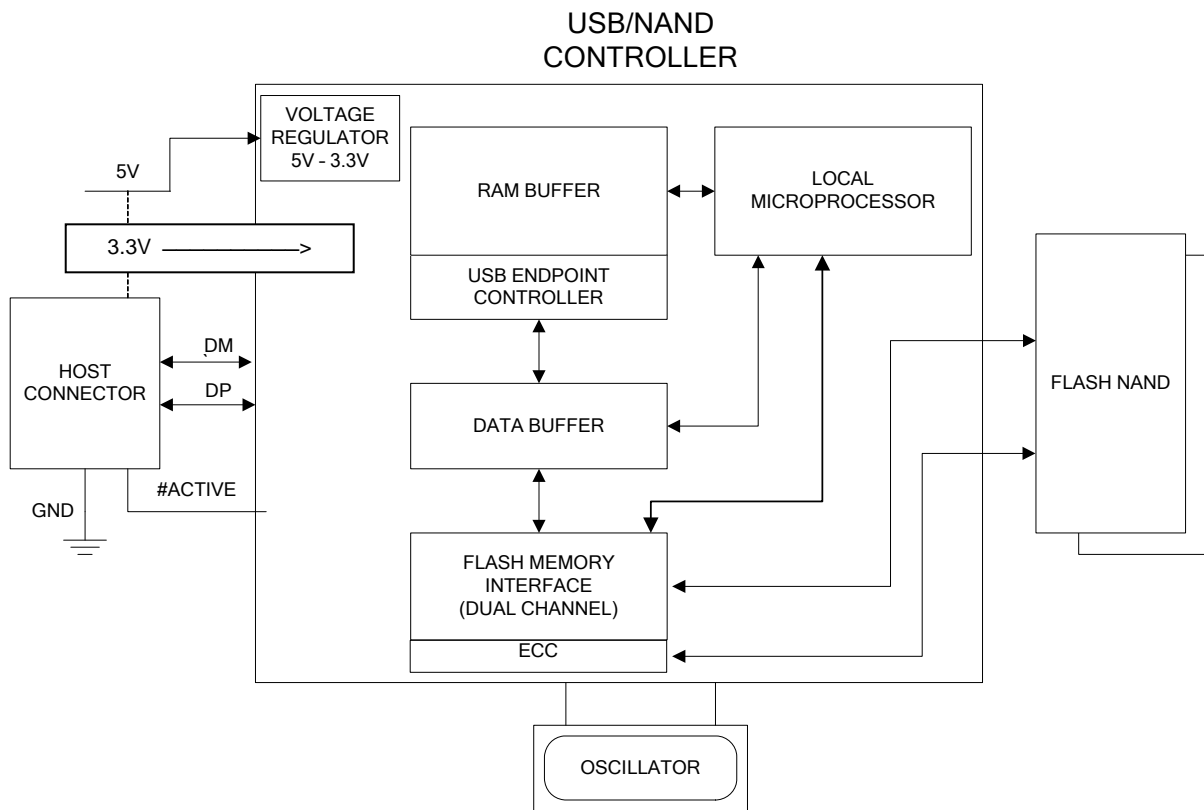


- Low power Dissipation- less than 0.45W active; less than 1mW standby
- Solid state, Non-volatile NAND Memory
- RoHS Compliant
- Static Wear Leveling

\* With exception of 3.3V only operation, USB specification is 5V.

### 1.3 Block Diagram

Figure 1-1: High-Level Block Diagram



Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 9 of 19

### 1.4 USB Interface

- The USB interface is compliant with the USB 2.0 specification.
- The USB interface connects the host computer to the embedded USB.
- The USB interface runs at a maximum speed of 2.0 Gbps (gigabits per second). If the host computer is unable to negotiate a speed of 2.0 Gbps, the USB interface automatically renegotiates to lower speeds.

## 2 Product Specifications

### 2.1 Performance

The host interface speed is 60MB/s with a read/write bandwidth shown in the following tables.

**Table 2-1: Maximum Sustained Read and Write Bandwidth**

Access Type	MB/s
Read, Dual Channel	Up to 35
Write, Dual Channel	Up to 23

### 2.2 Timing

**Table 2-2: Timing Specifications**

#### 2.3 Power-up AC timing Requirements

Parameter	Symbol	Min.	Typical	Max.	Unit
Powerup to Ready (from 2.7V VBUS)	tRESET	100	150	250	ms

**Notes:**

1. This power-up timing can be changed to 10ms upon request. The long power-up delay is designed to accommodate slow power-up times of rack systems.

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 10 of 19

## 2.4 Electrical Characteristics

### 2.4.1 Absolute Maximum Ratings

**Table 2-3: Absolute Maximum Ratings**

Parameter	Symbol	Value	Unit
5.0 Supply Voltage	VBUS	-0.3 ~ 5.5	V
3.3 Supply Voltage	VBUS	-0.3 ~ 4.0	V
Input Voltage	VIN	GND - 0.5 ~ VCC + 0.5	V
Storage Temperature	TST	-55 ~ 150	°C

**Notes:**

1. Permanent device damage may occur if 'ABSOLUTE MAXIMUM RATINGS' are exceeded. Functional operation should be restricted to recommended operating condition. Exposure to higher than recommended voltage for extended periods of time could affect device reliability.

### 2.4.2 DC Operating Conditions and Characteristics

**Table 2-4: Voltage and Current Ratings**

Parameter			Symbol	Min.	Typical	Max.	Unit
5.0 Supply voltage			VBUS	4.2	5.0	5.5	V
3.3 Supply voltage			VBUS	3.0	3.3	3.6	V
Regulated Output Voltage (internal eUSB voltage)			VDD33O	2.9	3.3	3.6	V
Input high voltage			VIH	2.0	-	-	V
Input low voltage			VIL	-	-	0.8	V
Output high voltage			VOH	2.4	-	-	V
Output low voltage			VOL	-	-	0.4	V
Standby Current	5.0V	1 Flash Device	I <sub>STB</sub>	-	16.5 + 6.6	23.1 + 33	µA
		2 Flash Devices		-	16.5 + 13.2	23.1 + 66	µA
		4 Flash Devices		-	16.5 + 19.8	23.1 + 132	µA
Operating Current	5.0V	1 Flash Device	I <sub>OP</sub>	-	132 + 9.9	165 + 19.8	mA
		2 Flash Devices		-	132 + 19.8	165 + 39.6	mA
		4 Flash Devices		-	132 + 39.6	165 + 79.2	mA
Standby Current	3.3V	1 Flash Device	I <sub>STB</sub>	-	25 + 10	35 + 50	µA
		2 Flash Devices		-	25 + 20	35 + 100	µA
		4 Flash Devices		-	25 + 30	35 + 200	µA
Operating Current	3.3V	1 Flash Device	I <sub>OP</sub>	-	200 + 15	250 + 30	mA
		2 Flash Devices		-	200 + 30	250 + 60	mA
		4 Flash Devices		-	200 + 60	250 + 120	mA

**Notes:**

1. Recommended operating conditions (Voltages referenced to GND, TA = 0 to 70C)

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 11 of 19

### 2.4.3 Power Consumption

All onboard power requirements of the eUSB are derived from the 5V or 3.3V input rail.

**Table 2-5: Power Consumption**

Power	Typical	units
Standby	1	mW
Operating	450	mW

### 2.4.4 Capacitance

**Table 2-6: Bus Line Capacitance**

Parameter	Symbol	Min	Max	Unit
Bus line capacitance	C <sub>L</sub>	-	20	pF

## 2.5 Environmental Conditions

### 2.5.1 Temperature and Altitude

**Table 2-7: Temperature and Altitude Related Specifications**

Conditions	Operating	Shipping	Storage
<b>Commercial Temperature</b>	0 to 70°C (32 to 158° F)	-40 to 85°C (-40 to 185° F)	-40 to 85°C (-40 to 185° F)
<b>Industrial Temperature<sup>1</sup></b>	-40 to 85°C (-40 to 185° F)	-40 to 85°C (-40 to 185° F)	-40 to 85°C (-40 to 185° F)
<b>Humidity (non-condensing)</b>	5% to 95%	5% to 95%	5% to 95%
<b>Max Temperature Gradient</b>	20°C/Hour (36°F/Hour)	n/a	n/a
<b>Altitude</b>	-304.8 to 24,384 m (-1,000 to 80,000 ft)	-304.8 to 24,384 m (-1,000 to 80,000 ft)	-304.8 to 24,384 m (-1,000 to 80,000 ft)
<b>Storage Time Duration</b>	n/a	n/a	1 year

**Notes:**

1. SLC flash based products are available in the following temperature ranges:
  - a) Commercial temperature range of 0 to 70°C (32 to 158° F)
  - b) Industrial temperature range -40 to 85°C (-40 to 185° F)

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 12 of 19

## 2.6 Reliability

**Table 2-8: Reliability Specifications**

Parameter	Value
Mean Time Between Failures (MTBF) <sup>1</sup>	2,500,000 hours
Power On/Off Cycles <sup>2</sup>	50,000 cycles
Read Endurance	Unlimited
Write or Erase Endurance <sup>3</sup>	(specified by the flash component)
Wear-leveling	Global
Data retention	>10 years

**Notes:**

1. MTBF is calculated based on a Part Stress Analysis. It assumes nominal voltage, with all other parameters within specified range. Telcordia method SR-332 component FIT rate at 55°C.
2. Power On/Off Cycles defined as power being removed from the drive, and then restored. Note that host systems and drive enclosures may remove power from the drive for reasons other than a system shutdown.
3. SLC NAND has a higher endurance than MLC NAND

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 13 of 19

### 3 Mechanical Information

The dimensions of the eUSB (version-1) are based on the following PCB #s: 1182, 1183, 1189, 1208, 1209, 1210

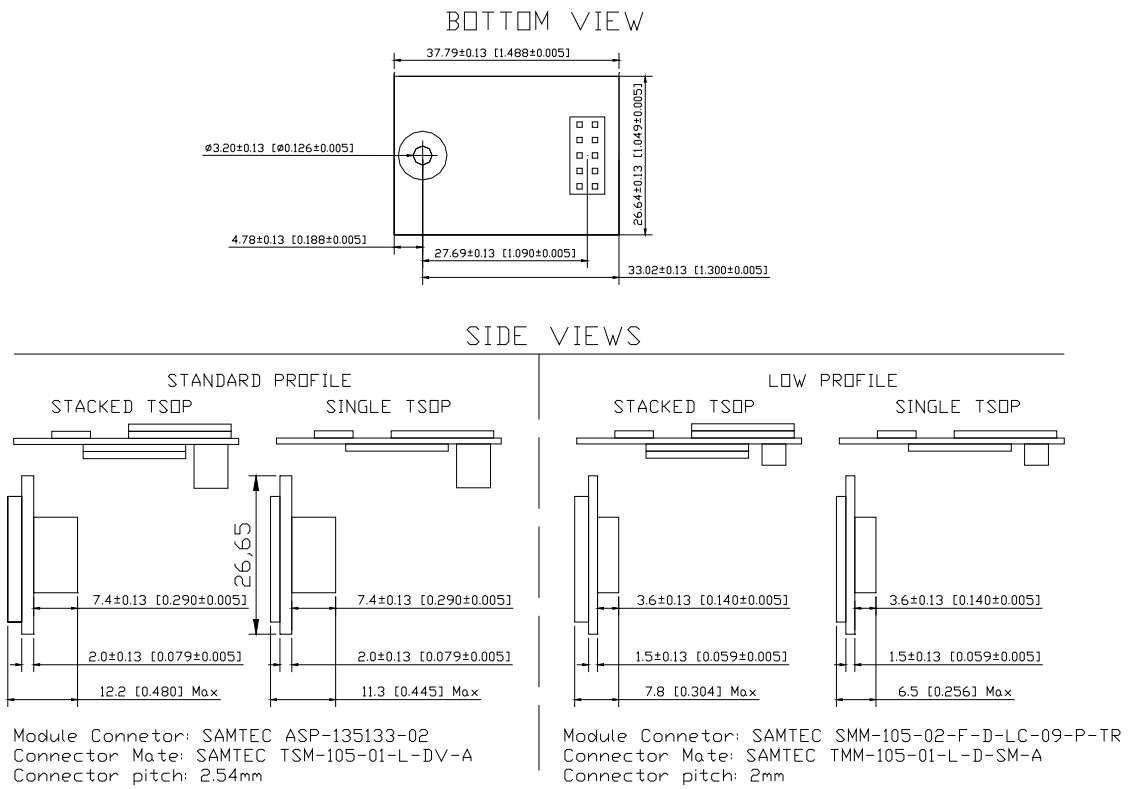
As an example, the 1182 PCB would have a 0001182A marking that is silkscreened at the bottom edge of the PCB near the mounting hole on the same side as the connector (at bottom side of the eUSB) as shown in the following figure.

**Figure 3-1: Location of PCB # marking**



Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 14 of 19

**Figure 3-2: Dimensions (Version-1)**

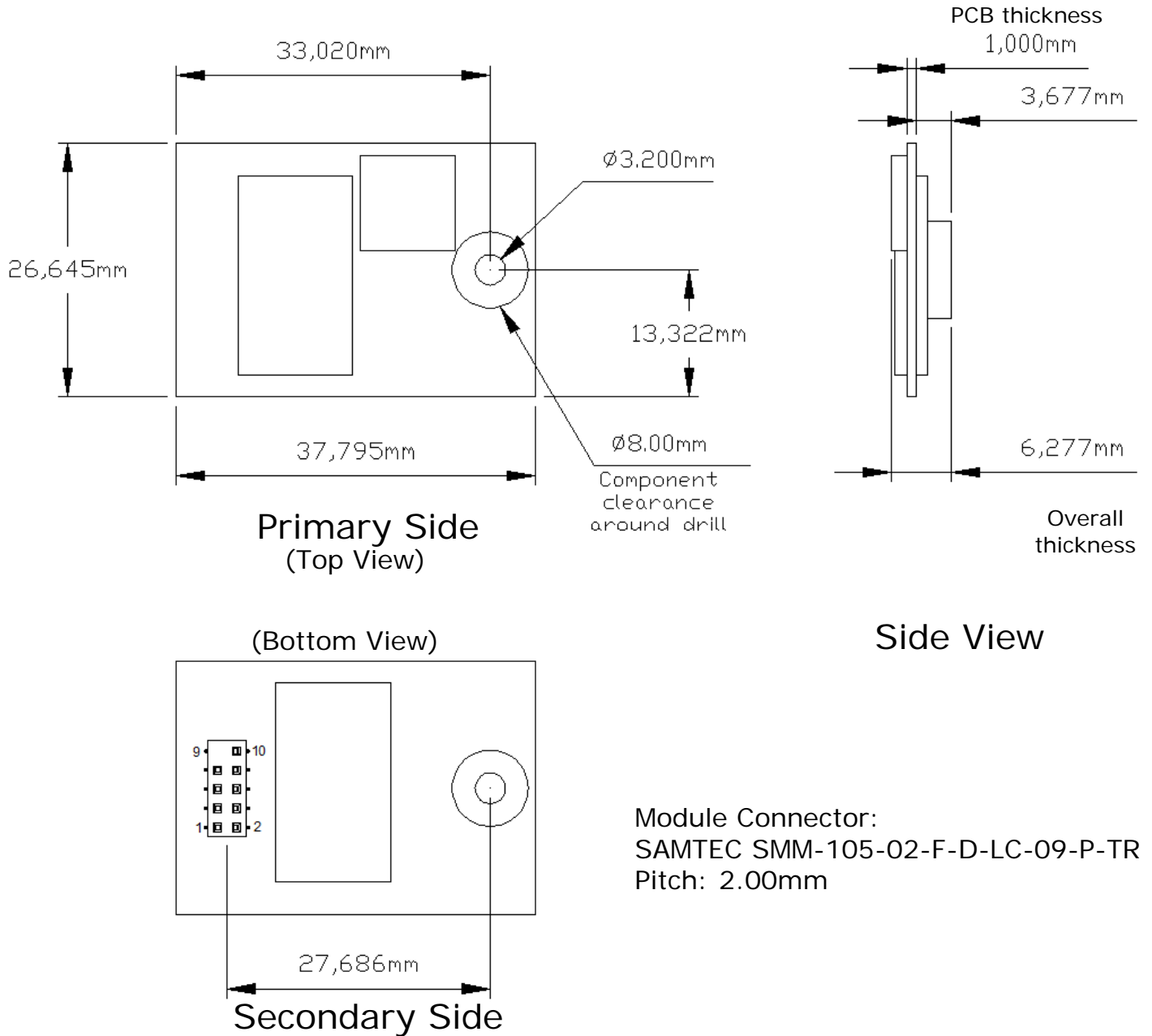


- PCB number is silkscreened on the PCB
- Dimensions shown in millimeters [inches]
- Max screw penetration is 5mm at all 4 locations.

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 15 of 19

The dimensions of the eUSB (version 2) are based on the following PCB #s: 1448, 1449

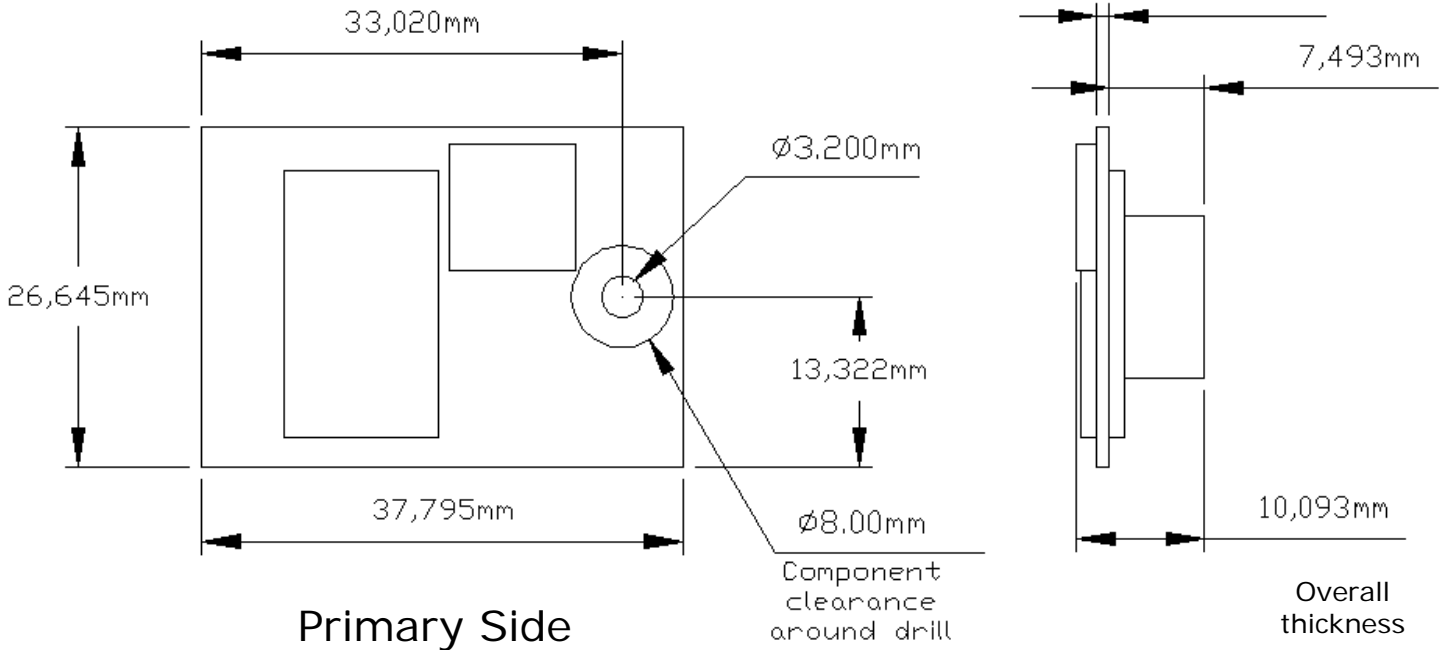
**Figure 3-3: Dimensions (Version-2, low profile)**



Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 16 of 19



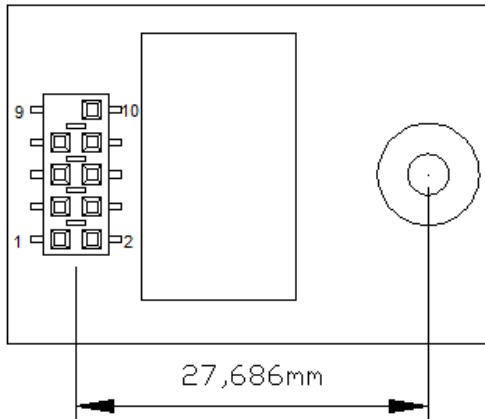
**Figure 3-4: Dimensions (Version 2, standard profile)**



**Primary Side**  
(Top View)

**Side View**

(Bottom View)



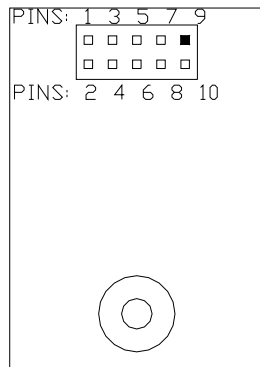
**Secondary Side**

Module Connector:  
SAMTEC SSM-105-L-DV-LC-009-P-TR  
Pitch: 2.54mm

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 17 of 19

## 4 Pin and Signal Descriptions

Figure 4-1: Connector Pin Assignments



### 4.1 Signal and Power Description Tables

Table 4-1: eUSB Connector Pin Signal Definitions

Pin	Signal Name	Type	Description
1	VBUS	Power	3.3 or 5V power supply
2	NC	NC	Not connected
3	DM	I/O	USB 2.0 Data Negative Pin
4	NC	NC	Not connected
5	DP	I/O	USB 2.0 Data Positive Pin
6	NC	NC	Not connected
7	GND	Power	Ground
8	NC	NC	Not connected
9	N/A	Key	Polarization
10	#Activity	I/O	Status signal that indicates when the drive is busy. This signal may be used to drive a low current LED or other logic on the host to indicate drive status to the user or system. This signal is active low and has a 4mA drive strength.

**Notes:**

- \* Available custom options: Pin 2 Chassis ground option; Pin 4 Hardware /WP; Pin 6 Hardware /Reset. Custom options available on locked BOMs only.

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 18 of 19

## 5 Certifications and Compliance

**Table 5-1: Device Certifications**

Certification/Compliance	Description
RoHS	Viking Technology, Sanmina Corporation ("Viking") shall use commercially reasonable efforts to provide components, parts, materials, products and processes to customers that do not contain: (i) lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) above 0.1% by weight in homogeneous material or (ii) cadmium above 0.01% by weight of homogeneous material, except as provided in any exemption(s) from RoHS requirements (including the most current version of the "Annex" to Directive\ 2002/95/EC of 27 January, 2003), as codified in the specific laws of the EU member countries. Viking strives to obtain appropriate contractual protections from its suppliers in connection with the RoHS Directives.
EU WEEE Compliant	The Waste Electrical and Electronic Equipment Directive (WEEE Directive) is the European Community directive 2002/96/EC on waste electrical and electronic equipment (WEEE) which, together with the RoHS Directive 2002/95/EC, became European Law in February 2003, setting collection, recycling and recovery targets for all types of electrical goods.
Safety	All printed circuit boards (PCBs) have a flammability rating of UL94V-0.

## 6 References

- USB Specification, version 2.0

## Index

Dimensions .....	15	MTBF .....	13
Endurance .....	13	Power Consumption .....	12
Environmental Conditions .....	12	<b>Temperature</b> .....	12
Erase Endurance .....	13	Timing Specifications .....	10
<b>Humidity</b> .....	12	Wear-leveling .....	13

Datasheet	5/23/2013
PSFDUC3XXXXRXX	Viking Technology
Revision E	Page 19 of 19