Viking eUSB

Embedded USB Manual
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Industrial Products

Revision History

Date	Revision	Description
X1	9/16/2014	Initial release on a modified PSFDUC3XXXXYXX_A1 (version 2 only). Revised Standby Current and Operating Current based on 3.3V NAND devices. Revised for single channel only and 2 flash device. Revise Voltage and Current Ratings table.
X2	1/15/15	Revise PN table per PSG_PartSelectionGuide_SSD_2015
A	1/30/15	Reviewed by DVT: Add VRFDUC3x016GACxxx to PN table
A1	3/3/2015	Revise Performance values per Engineering. Remove Power table 2-5. Updated to final for review and signoff
B	3/13/2015	Revise per DVT review
C	6/03/2015	Add 4GB and 8GB PSLC
D	7/27/2015	Add VRFDUC3L016GACRTH (7-22-15) and VRFDUC34096ACW01 (7/27/2015)
E	7/30/2015	change VRFDUC3L016GACRTH to low Profile change SLC 24nm based product to enterprise (7/29/2015) add notes on 3.3v vs. 5v (7/30/2015)
F	9/1/2015	Add VRFDUC3L016GACR3TH per PSG update. (8/15/15) Change pSLC in MLC PN's to client application per IDC review. (9/1/2015) VRFDUC3L032GACSTH (9/30) SLC performance based on IOMeter 2006 using a 32GB eUSB with Toshiba SLC NAND toggle.
G	9/30/2015	Add VRFDUC3L032GACSTH and update SLC performance based on IOMeter 2006 using a 32GB eUSB with Toshiba SLC NAND toggle.
H	11/10/2015	Update SLC performance based new controller FW for HyMap.
I	5/12/16	Add "max" to height measurement
J	10/31/16	Add VRFDUC38192AIRZ1
K	3/6/17	DVT Iometer 2006 performance run showing sustained read and write speeds for VRFDUC3032GACSE2 with Toshiba 128Gbit SLC H die BGA
L	3/9/17	Revise PN table

Legal Information

Legal Information

Ordering Information: eUSB Family

Viking High Performance USB embedded Drive Ordering Information for
USB 2.0 using Hyperstone U8 controller

Part Number Decoder	Form Factor	xxxx =Capacity (GB)	Controller	Temp	y= Device code	Voltage	NAND	Customer unique Alpha Numeric
VRFDUC3(L)xxxxACy(3)(M)zz	Blank=eUSB Std Profile L=eUSB Low Profile	4G=4096 8G=8192 16G=016G 32G=032G	A= Hyperstone U8	I=(-40 to +85 ºC) C=(0 to +70'c)		3 = 3.3V Blank=5V	M=MLC Blank= SLC	zz=wildcard characters Blank= Generic

Note:
1. The pSLC (pseudo-SLC firmware) part numbers use double the user MLC NAND and Hyperstone U8 controller with pSLC firmware
2. Modules are 5V standard and 3.3V selectable by BOM resistor options.

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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)*
  - Specification for Host Interface up to 60MB/s (480Mbit/s)
- Drive Activity indicator signal
- Firmware upgradeable via USB bus
- Low power Dissipation
- 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

USB/NAND
CONTROLLER

3.3V / 5.0V	VOLTAGE REGULATOR 5V – 3.3V	

RAM BUFFER ↔ LOCAL MICROPROCESSOR

USB ENDPOINT CONTROLLER

HOST CONNECTOR — DM / DP / #ACTIVE

GND

DATA BUFFER

FLASH MEMORY INTERFACE (SINGLE CHANNEL)

ECC

FLASH NAND

OSCILLATOR
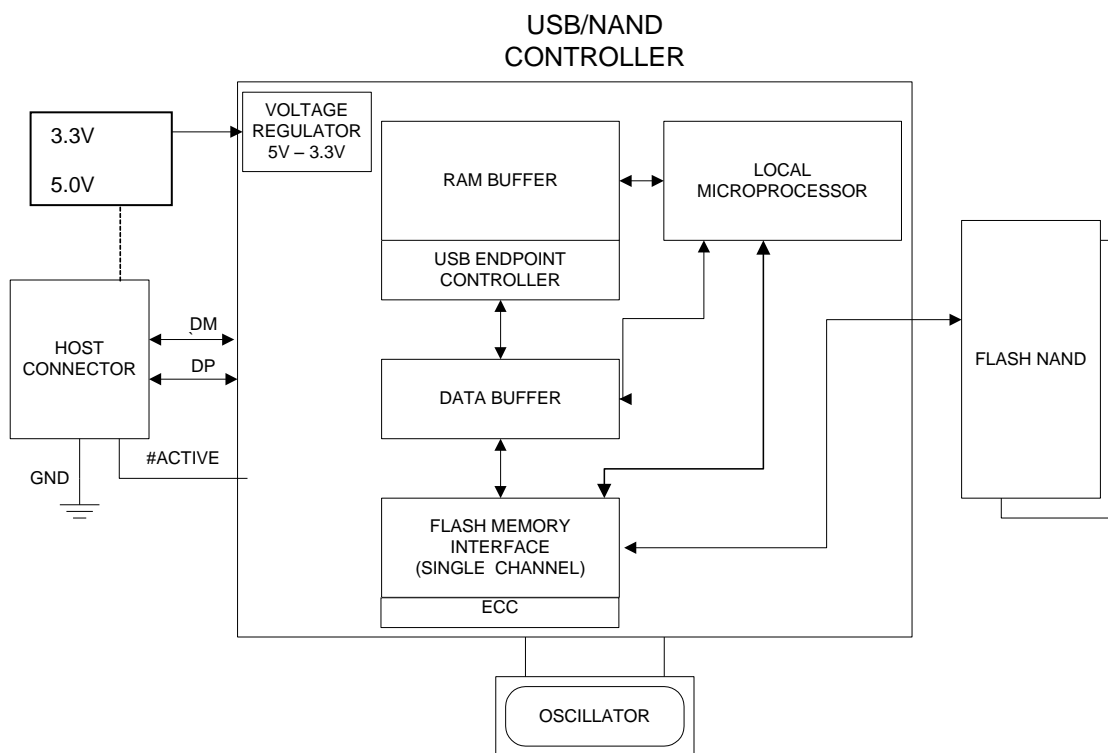
Notes: Up to 4 CE on a channel. (8 CE may be configurable via GPIO firmware option)

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 2.0 interface runs at a maximum speed of 480Mbps (megabits per second). If the host computer is unable to negotiate highest speed, the USB interface automatically renegotiates to lower speeds.

2 Product Specifications

2.1 Performance

The host interface speed is 480Mbit/s with a read/write bandwidth shown in the following table.

Table 2-1: Maximum Sustained Read and Write Bandwidth

Access Type	MB/s (100% Sequential)
SLC: Read, Single Channel	Max Up to 33
SLC: Write, Single Channel	Max Up to 28

Note:
DVT Iometer 2006 performance run showing sustained read and write speeds for VRFDUC3032GACSE2 with Toshiba 128Gbit SLC H die BGA

2.2 Timing

Table 2-2: Timing Specifications

2.3 Power-up AC timing Requirements

Parameter	Symbol	Min.	Typical	Max.	Unit
Power on Time 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.

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 ~ 3.6	V
Input Voltage	VIN	GND - 0.5 ~ VCC + 0.3	V
Storage Temperature	TST	-40 ~ 125	°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 (± 5%)		VBUS	4.75	5.0	5.25	V
3.3 Supply voltage (± 5%)		VBUS	3.135	3.3	3.465	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[2]	1 Flash Device	I_{STB}	-	16.5 + 6.6	23.1 + 33	µA
	2 Flash Devices		-	16.5 + 13.2	23.1 + 66	µA
Operating Current[2]	1 Flash Device	I_{OP}	-	132 + 9.9	165 + 19.8	mA
	2 Flash Devices		-	132 + 19.8	165 + 39.6	mA

Notes:

1. Recommended operating conditions (Voltages referenced to GND, TA = 0 to 70C)
2. Based on 3.3V NAND, BGA or TSOP

2.4.3 Power Consumption

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

2.4.4 Capacitance

Table 2-5: Bus Line Capacitance

Parameter	Symbol	Min	Max	Unit
Bus line capacitance	C_L	-	20	pF

2.5 Environmental Conditions

2.5.1 Temperature and Altitude

Table 2-6: Temperature and Altitude Related Specifications

Conditions	Operating	Shipping	Storage
Commercial	0 to 70°C	-40 to 125°C	-40 to 125°C
Industrial[1]	0 to 70°C or -40 to 85°C	-40 to 125°C	-40 to 125°C
Humidity (non-condensing)	5% to 95%	5% to 95%	5% to 95%
Max Temperature Gradient	20°C/Hour	n/a	n/a
Altitude	-304.8 to 24,384 m	-304.8 to 24,384 m	-304.8 to 24,384 m
Storage Time	n/a	n/a	1 year

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

2.6 Reliability

Table 2-7: Reliability Specifications

Parameter	Value
ECC	96-Bit/1KB BCH

Parameter	Value
Mean Time Between Failures (MTBF)[1]	2,500,000 hours
Power On/Off Cycles[2]	50,000 power cycles
Read Endurance	Unlimited
Write or Erase Endurance	SLC: 60-100K PE
	pSLC: 30K PE
	MLC: 3K PE
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 Mechanical Information

Figure 3-1: Dimensions (low profile)

33,020mm

26,645mm

37,795mm

Ø3.200mm

13,322mm

Ø8,00mm
Component
clearance
around drill

Primary Side
(Top View)

(Bottom View)

27,686mm

Secondary Side

PCB thickness
1,000mm

3,677mm

6.277mm Max

Overall
thickness

Side View

9 · 10

1 · 2

Low profile Module Connector:
SAMTEC SMM-105-02-F-D-LC-09-P-TR
Pitch: 2.00mm

Figure 3-2: Dimensions (standard profile)

PCB thickness

1,000mm

See Note 4

33,020mm

Ø3.200mm

26,645mm

13,322mm

37,795mm

Ø8.00mm

Component clearance around drill

Primary Side

(Top View)

10.093mm Max

Overall thickness

Side View

(Bottom View)
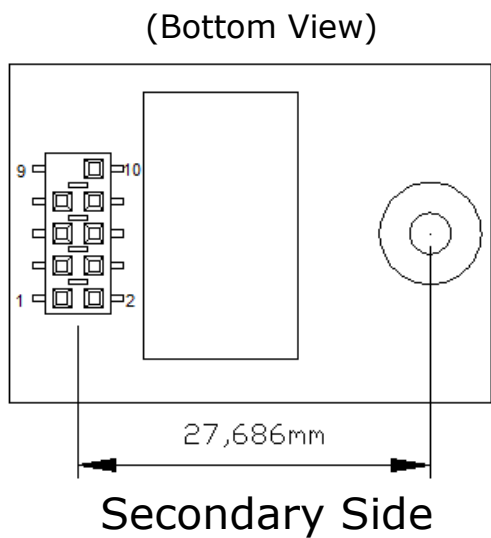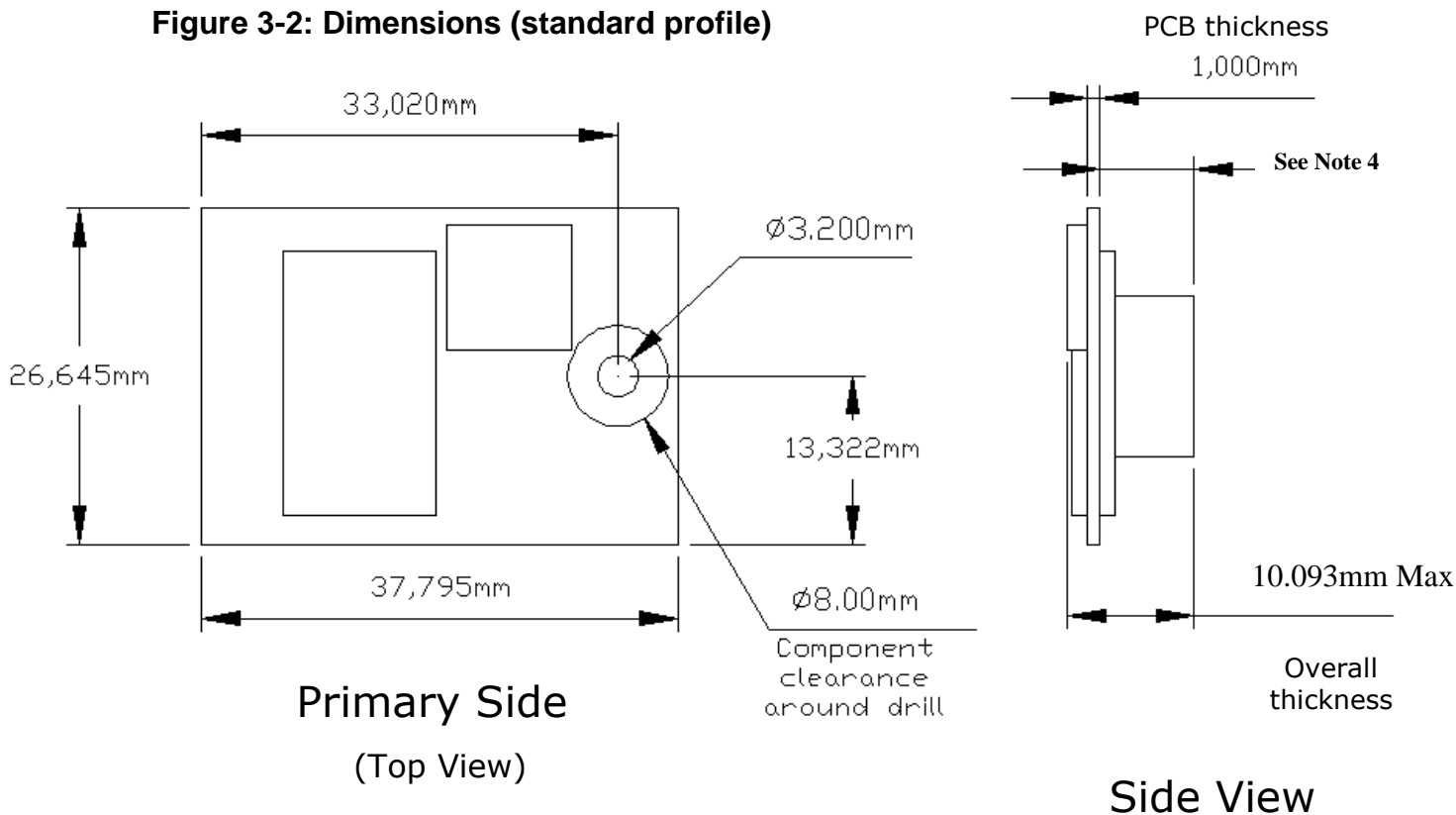
Notes:
1. Standard Profile Module Connector:
   SAMTEC SSM-105-L-DV-LC-009-P-TR
   Pitch: 2.54mm
2. Dimensions shown in millimeters
3. Max screw penetration is 5mm at all 4 locations.
4. The module connector height is
   7.4 ± 0.13 [0.290± 0.005]

27,686mm

Secondary Side

Manual	3/9/2017
PSFDUC3XXXXAXX	Viking Technology
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4 Pin and Signal Descriptions

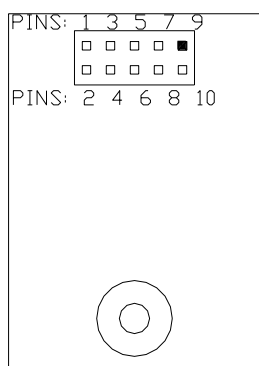**Figure 4-1: Connector Pin Assignments**

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:

1. * Available custom options: Pin 2 Chassis ground option; Pin 4 Hardware /WP; Pin 6 Hardware /Reset. Custom options available on locked BOMs only.
2. 3.3 or 5V is designated by the part number

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 2.00
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