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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

Revision History

Rev	Date	Details
A	October 14, 2008	New release of Short and Legacy eUSB Spec with SM325AC controller

Corporate Headquarters: P. O. Box 1757, Fremont, CA 94538, USA • Tel:(510) 623-1231 • Fax:(510) 623-1434 • E-mail: info@smartm.com
Flash Design Center: 3 Highwood Drive, Suite 103E, Tewksbury , MA 01876 USA • Tel:(978) 805-2100 • Fax:(978) 805-2357
Asia: Plot 18, Lrg Jelawat 4, Kawasan Perindustrian Seberang Jaya 13700, Prai, Penang, Malaysia • Tel: +604-3992909 • Fax: +604-3992903

SMART eUSB Drive

1.0 General Description

1.1 Overview

The SMART INDUSTRIAL GRADE eUSB Drive is a robust “SLC” flash based hard drive designed for use as the main boot and storage device for embedded systems. The small form factor, low power consumption and fast access time are important advantages a SMART eUSB Drive has over traditional hard drives. The drive uses a USB 2.0 High Speed serial link providing a simple two wire signaling interface to the host.

The SMART eUSB Drive is available in sizes up to 16GB, Commercial or Industrial temperature, and 5V or 3.3V power. The drive is capable of sustained read speeds up to 35MB/s and write speeds up to 24MB/s. The time to access a random location is typically less than 1 ms for the drive.

1.2 Features

- Universal Serial Bus 2.0 (Hi-Speed USB) compatible
- 2 wire small form factor USB interface to host
- Industry standard header, or low profile stacking header for connecting to the host
- Read Speed up to 35 MB/s and write Speed up to 24 MB/s
- Capacity range from 256GB to 16GB
- BCH Error Correction Code - corrects up to 8 bit errors per 512 byte sector
- Low power Dissipation- less than .45W active (.68W for 5V version) and less than 1mW standby
- Dynamic and Static Wear Leveling
- Commercial Temp range 0º C to 70º
- Industrial Temp range -40º C to 85º
- Firmware upgradeable via USB bus
- Support USB Mass Storage Class requirements for Bootability
- Remote Write Protect and drive Reset Control options available
- Life Monitoring (Vendor Commands)
- Descriptors programmed into 256 Bytes of Attribute Memory

1.3 Ordering Information

SMART Legacy Standard Connector (.385in high)									
Part Number	**Supply Voltage**	**Connector**	**Physical Capacity**	**Chip Density**	**Chip Quantity**	**Read Speed (MB/s)**	**Write Speed (MB/s)**	**Random Access Time**	**Typ. Write Current**
SG9ED52L256G1	5	Legacy	256MB	1Gb	2	31	12	.4	80
SG9ED52L512G2	5	Legacy	512MB	2Gb	2	31	17	.4	90
SG9ED52L1GG4	5	Legacy	1GB	4Gb	2	30	17	.5	100
SG9ED52L2GGD	5	Legacy	2GB	8Gb, 4K	2	33	17	.5	100
SG9ED52L2GG9	5	Legacy	2GB	8Gb	2	33	17	.6	100
SG9ED52L4GGC	5	Legacy	4GB	16Gb, 4K	2	32	17	.6	110
SG9ED52L4GGA	5	Legacy	4GB	16Gb	2	32	24	.6	110
SG9ED52L8GGB	5	Legacy	8GB	32Gb, 4K	2	35	15	.6	110
SG9ED52L16GGB	5	Legacy	16GB	32Gb, 4K Stacked	2	28.6	15	.8	110
SMART Legacy Low Profile Connector (.290in high)									
Part Number	**Supply Voltage**	**Connector**	**Physical Capacity**	**Chip Density**	**Chip Quantity**	**Read Speed (MB/s)**	**Write Speed (MB/s)**	**Random Access Time**	**Typ. Write Current**
SG9ED52U256G1	5	Legacy Low Profile	256MB	1Gb	2	31	12	.4	80
SG9ED52U512G2	5	Legacy Low Profile	512MB	2Gb	2	31	17	.4	90
SG9ED52U1GG4	5	Legacy Low Profile	1GB	4Gb	2	30	17	.5	100
SG9ED52U2GGD	5	Legacy Low Profile	2GB	8Gb, 4K	2	33	17	.5	100
SG9ED52U2GG9	5	Legacy Low Profile	2GB	8Gb	2	33	17	.6	100
SG9ED52U4GGA	5	Legacy Low Profile	4GB	16Gb	2	32	24	.6	110
SG9ED52U4GGC	5	Legacy Low Profile	4GB	16Gb, 4K	2	32	17	.6	110
SG9ED52U8GGB	5	Legacy Low Profile	8GB	32Gb, 4K	2	35	15	.6	110
SG9ED52U16GGB	5	Legacy Low Profile	16GB	32Gb, 4K Stacked	2	28.6	15	.8	110

1.3 Ordering Information Continued

SMART Legacy 2mm Connector (.144in high)									
Part Number	Supply Voltage	Connector	Physical Capacity	Chip Density	Chip Quantity	Read Speed (MB/s)	Write Speed (MB/s)	Random Access Time	Typ. Write Current
SG9ED52M256G1	5	Legacy 2mm	256MB	1Gb	2	31	12	.4	80
SG9ED52M512G2	5	Legacy 2mm	512MB	2Gb	2	31	17	.4	90
SG9ED52M1GG4	5	Legacy 2mm	1GB	4Gb	2	30	17	.5	100
SG9ED52M2GGD	5	Legacy 2mm	2GB	8Gb, 4K	2	33	17	.5	100
SG9ED52M2GG9	5	Legacy 2mm	2GB	8Gb	2	33	17	.6	100
SG9ED52M4GGC	5	Legacy 2mm	4GB	16Gb, 4K	2	32	17	.6	110
SG9ED52M4GGA	5	Legacy 2mm	4GB	16Gb	2	32	24	.6	110
SG9ED52M8GGB	5	Legacy 2mm	8GB	32Gb, 4K	2	35	15	.6	110
SG9ED52M16GGB	5	Legacy 2mm	16GB	32Gb, 4K Stacked	2	28.6	15	.8	110

1.3 Ordering Information Continued

SMART Stacking Top 9-Pin Locking Connector									
Part Number	**Supply Voltage**	**Connector**	**Physical Capacity**	**Chip Density**	**Chip Quantity**	**Read Speed (MB/s)**	**Write Speed (MB/s)**	**Random Access Time**	**Typ. Write Current**
SG9ED32T256G1	3.3	Stacking-Top	256MB	1Gb	2	31	12	.4	80
SG9ED32T512G2	3.3	Stacking-Top	512MB	2Gb	2	31	17	.4	90
SG9ED32T1GG4	3.3	Stacking-Top	1GB	4Gb	2	30	17	.5	100
SG9ED32T2GGD	3.3	Stacking-Top	2GB	8Gb, 4K	2	33	17	.5	100
SG9ED32T2GG9	3.3	Stacking-Top	2GB	8Gb	2	33	17	.6	100
SG9ED32T4GGC	3.3	Stacking-Top	4GB	16Gb, 4K	2	32	17	.6	110
SG9ED32T4GGA	3.3	Stacking-Top	4GB	16Gb	2	32	24	.6	110
SG9ED32T8GGB	3.3	Stacking-Top	8GB	32Gb, 4K	2	35	15	.6	110
SG9ED32T16GGB	3.3	Stacking-Top	16GB	32Gb, 4K Stacked	2	28.6	15	.8	110
SMART Stacking Bottom 9-pin Locking Connector									
Part Number	**Supply Voltage**	**Connector**	**Physical Capacity**	**Chip Density**	**Chip Quantity**	**Read Speed (MB/s)**	**Write Speed (MB/s)**	**Random Access Time**	**Typ. Write Current**
SG9ED32B256G1	3.3	Stacking-Bot	256MB	1Gb	2	31	12	.4	80
SG9ED32B512G2	3.3	Stacking-Bot	512MB	2Gb	2	31	17	.4	90
SG9ED32B1GG4	3.3	Stacking-Bot	1GB	4Gb	2	30	17	.5	100
SG9ED32B2GGD	3.3	Stacking-Bot	2GB	8Gb, 4K	2	33	17	.5	100
SG9ED32B2GG9	3.3	Stacking-Bot	2GB	8Gb	2	33	17	.6	100
SG9ED32B4GGC	3.3	Stacking-Bot	4GB	16Gb, 4K	2	32	17	.6	110
SG9ED32B4GGA	3.3	Stacking-Bot	4GB	16Gb	2	32	24	.6	110
SG9ED32B8GGB	3.3	Stacking-Bot	8GB	32Gb, 4K	2	33	15	.6	110
SG9ED32B16GGB	3.3	Stacking-Bot	16GB	32Gb, 4K Stacked	2	28.6	15	.8	110

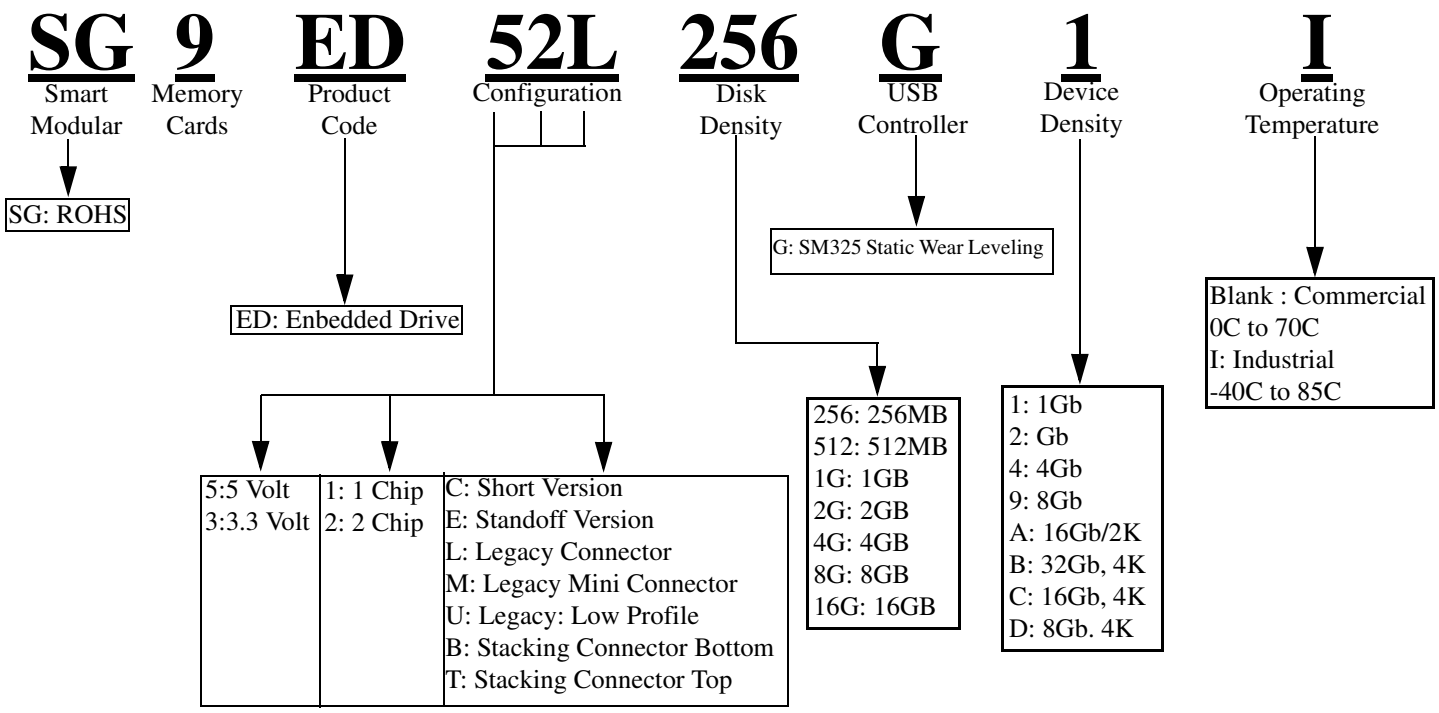
1.3 Ordering Information Continued

SMART Short eUSB With Standoff Connector									
Part Number	Supply Voltage	Connector	Physical Capacity	Chip Density	Chip Quantity	Read Speed (MB/s)	Write Speed (MB/s)	Random Access Time	Typ. Write Current
SG9ED31E256G1	3.3	Standoff eUSB	256MB	1Gb	2	31	12	.4	80
SG9ED31E512G4	3.3	Standoff eUSB	512MB	4Gb	1	18	10	.6	90
SG9ED32E512G2	3.3	Standoff eUSB	512MB	2Gb	2	31	17	.4	90
SG9ED32E1GG4	3.3	Standoff eUSB	1GB	4Gb	2	30	17	.5	100
SG9ED32E2GGD	3.3	Standoff eUSB	2GB	8Gb, 4K	2	33	17	.5	100
SG9ED32E2GG9	3.3	Standoff eUSB	2GB	8Gb	2	33	17	.6	100
SG9ED32E4GGC	3.3	Standoff eUSB	4GB	16Gb, 4K	2	35	15	.6	110
SG9ED32E4GGA	3.3	Standoff eUSB	4GB	16Gb	2	32	24	.6	110
SG9ED32E8GGB	3.3	Standoff eUSB	8GB	32Gb	2	32	15	.6	110
SG9ED32E16GGB	3.3	Standoff eUSB	16GB	32Gb, 4K Stacked	2	28.6	15	.8	110

1.3.1 Part Number Geometry

Page Size	Part Number	Drive Capacity	Unformatted Capacity	Cylinders	Heads	Sectors Track	Maximum LBA
2K/PG Flash	SG9EDxxx256G1	256MB	256,900,608	978	16	32	5017759
	SG9EDxxx512G2	512MB	513,801,728	995	16	63	1003519
	SG9EDxxx1GG4	1GB	1,027,603,968	1991	16	63	2007039
	SG9EDxxx2GG9	2GB	2,055,208,448	4072	16	63	4014079
	SG9EDxxx4GGA	4GB	4,110,417,408	7964	16	63	8028159
4K/PG Flash	SG9EDxxx2GGD	2GB	2,013,265,408	3900	16	63	3932159
	SG9EDxxx4GGC	4GB	4,026,531,328	7801	16	63	7864319
	SG9EDxxx8GGB	4GB	8,052,129,792	15602	16	63	15728639

Part Number Decoder



1.4 Device Operational Characteristics

1.4.1 Transfer Rates .

	2 Chip Solution
• Write Data Transfer Rate	24MB/s (2kp 4GB drive)
• Read Data Transfer Rate	35MB/s (2kp 4GB drive)
• Host Interface Speed	60MB/s

(Refer to chart on page 3 for performance of other capacities)

1.4.2 Reliability

• MTBF	>6,000,000 Hours
• Write/Erase	>2M Cycles

1.4.3 Power Requirements

(All listed values are typical based on highest power drive configuration . Refer to chart on page 3 for active current requirements of other capacities)

	2 Chip Solution
• VCC	5.0V±5%; 3.3V±10%
• Idle Current	50mA
• Write Current	130mA
• Standby Current	2mA

1.4.4 Environmental Characteristics

• Operating temperature	0ºC to +70ºC (Commercial) -40ºC to +85ºC (Industrial)
• Storage temperature	-55ºC to +150ºC
• Humidity	70% to 85%
• Shock	80G max
• Vibration	1.12 grms (3 to 500 Hz)
• Altitude	3000 m

1.4 Device Operational Characteristics Continued

1.4.5 Physical Dimensions

	Legacy Connector	Stacking Connector	Legacy 2mm
• Length PCB	1.36 in. (34.54mm)	1.65 in. (41.91mm)	1.45 in. (36.9mm)
• Width PCB	0.99 in. (25.15mm)	.906 in. (23.00mm)	1.05 in. (26.6mm)
• Mounted Height	0.591 in (15.02mm) *(Standard)* 0.381 in (9.68mm) *(Low Profile)*	0.277in. (7.04mm) *(Single)* 0.468in. (11.8mm) *(Double)*	0.24in (6.0mm)

1.4.6 Physical Dimensions Short eUSB

	Short eUSB W/Standoff
• Length	1.496 in. (38mm)
• Width	0.906 in. (23mm)
• Mounted Height	0.211in. (5.39mm)

1.5 MTBF Information

SMART Modular Reliability Modeling

Product reliability is based upon several key factors. Every semiconductor component manufacturer publishes a "reliability report" associated with each component. There are several means of reporting and representing these reliability statistics within the industry standard formats. The two major formats of "product reliability" are the abbreviated terms of **MTBF** (Mean Time Between Failure, in hours) and the **FIT Rate** (Failures Per Billion hours). These two terms of reliability factors are the most commonly used within the Electronics Semiconductor Industry.

Reliability Models are based upon internal components specific to each product and will vary widely based upon the internal components technology family, and internal operating conditions for a given application. Reliability Modeling will extrapolate approximate product life-span calculations by utilizing known reliability factors from each component manufacturer, over a given temperature range and operating parameters.

There are several industry standard software packages available for product reliability modeling. Smart Modular utilizes Item Software's reliability model, the **RDF2000 UTE C 80-810 Telecom Standard.** Smart Modular Technology has derived the following reliability statistics based upon numerous specifics related to and including; internal component packaging, pin configurations, component density, and internal component substrate architecture.

Product reliability modeling for Smart Modular Technology is based upon continual usage of the product, within accepted normal operating parameters. Compromise of the published normal operating parameters will adversely effect the product life-span reliability model. For a more detailed breakdown analysis, contact Smart Modular Customer Support.

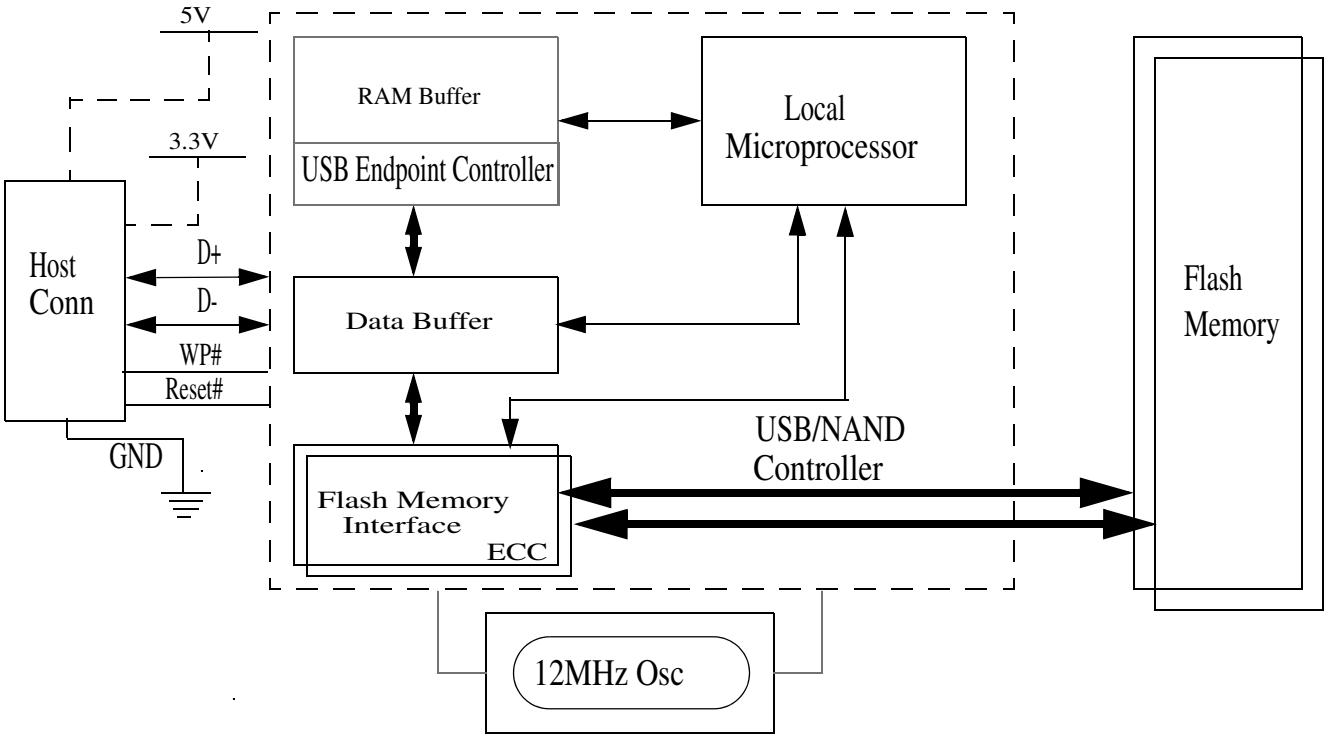
E-USB 2GB @25ºC

FPBH (Failures Per Billion Hours)	MTBF (Hours)
112	8,863,894

2.0 General Description

The Smart eUSB Drive contains a USB/NAND controller and one or two flash memory devices. The controller interfaces with a host system allowing data to be written and read from the flash memory device.

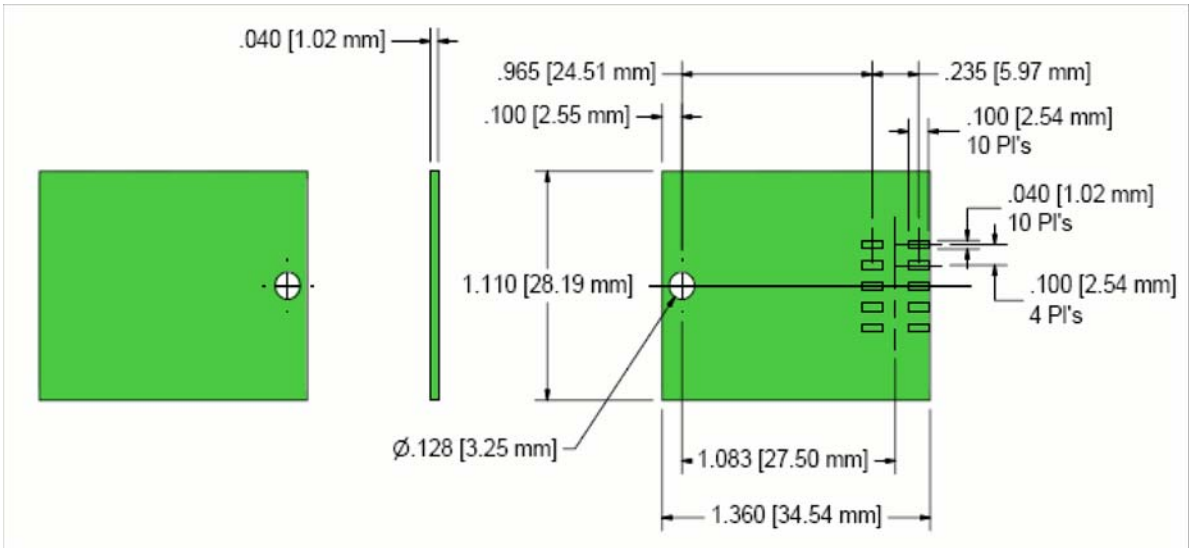
2.1 Functional Block Diagram



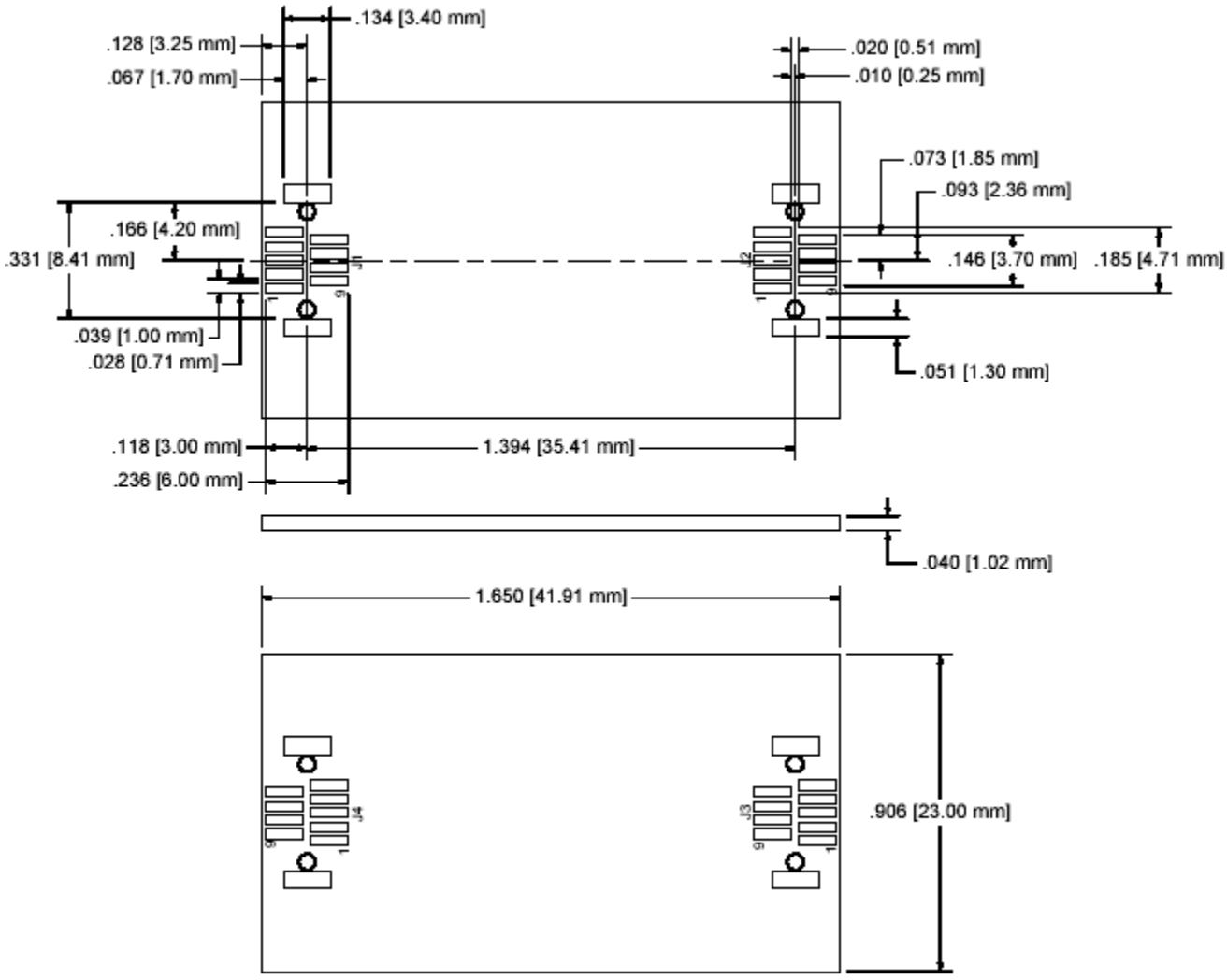
2.2 Physical Specifications

All dimensions in Inches

2.2.1 Board Dimensions- Legacy Connector

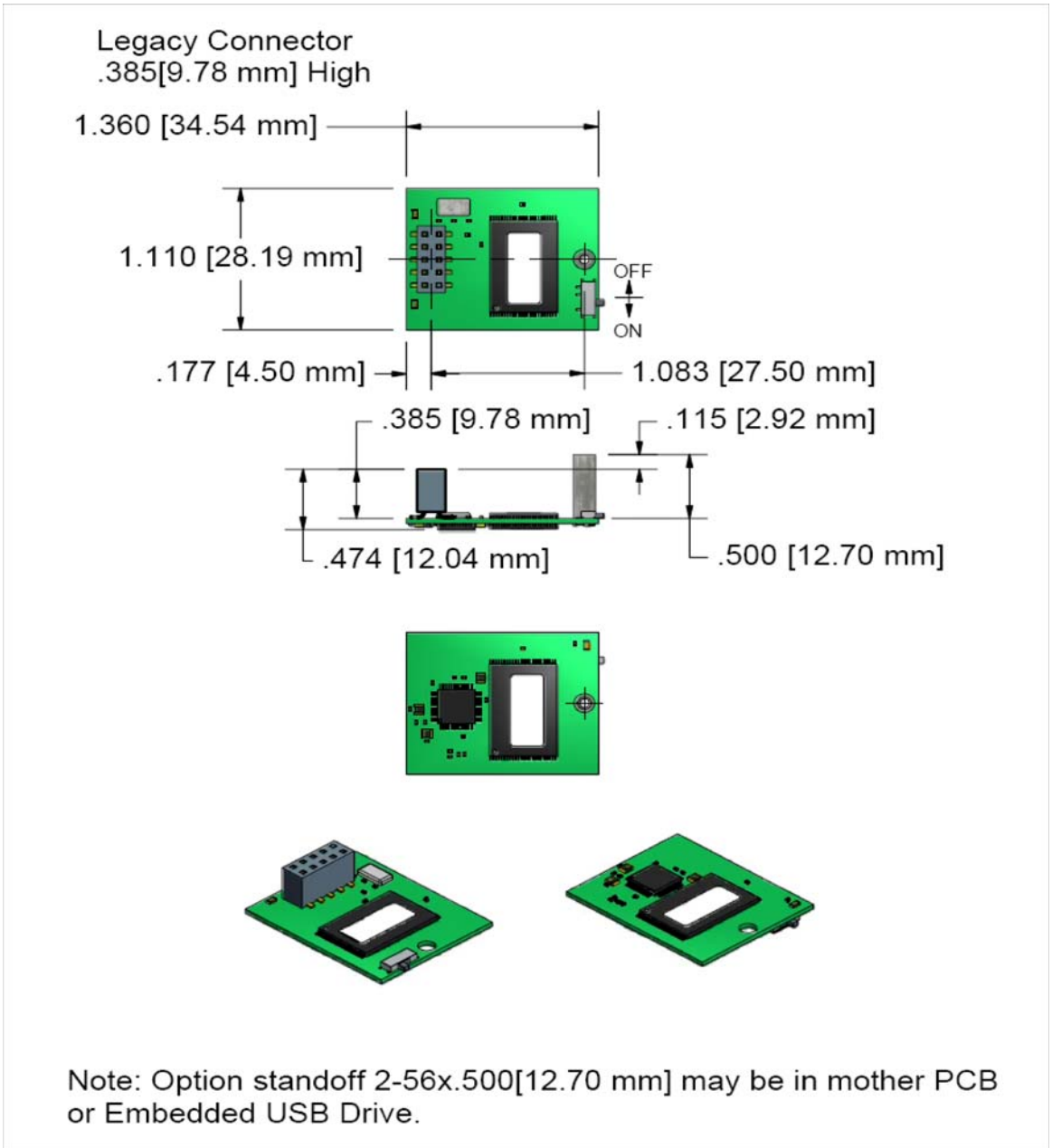


2.2.2 Board Dimensions- Stacking Connector

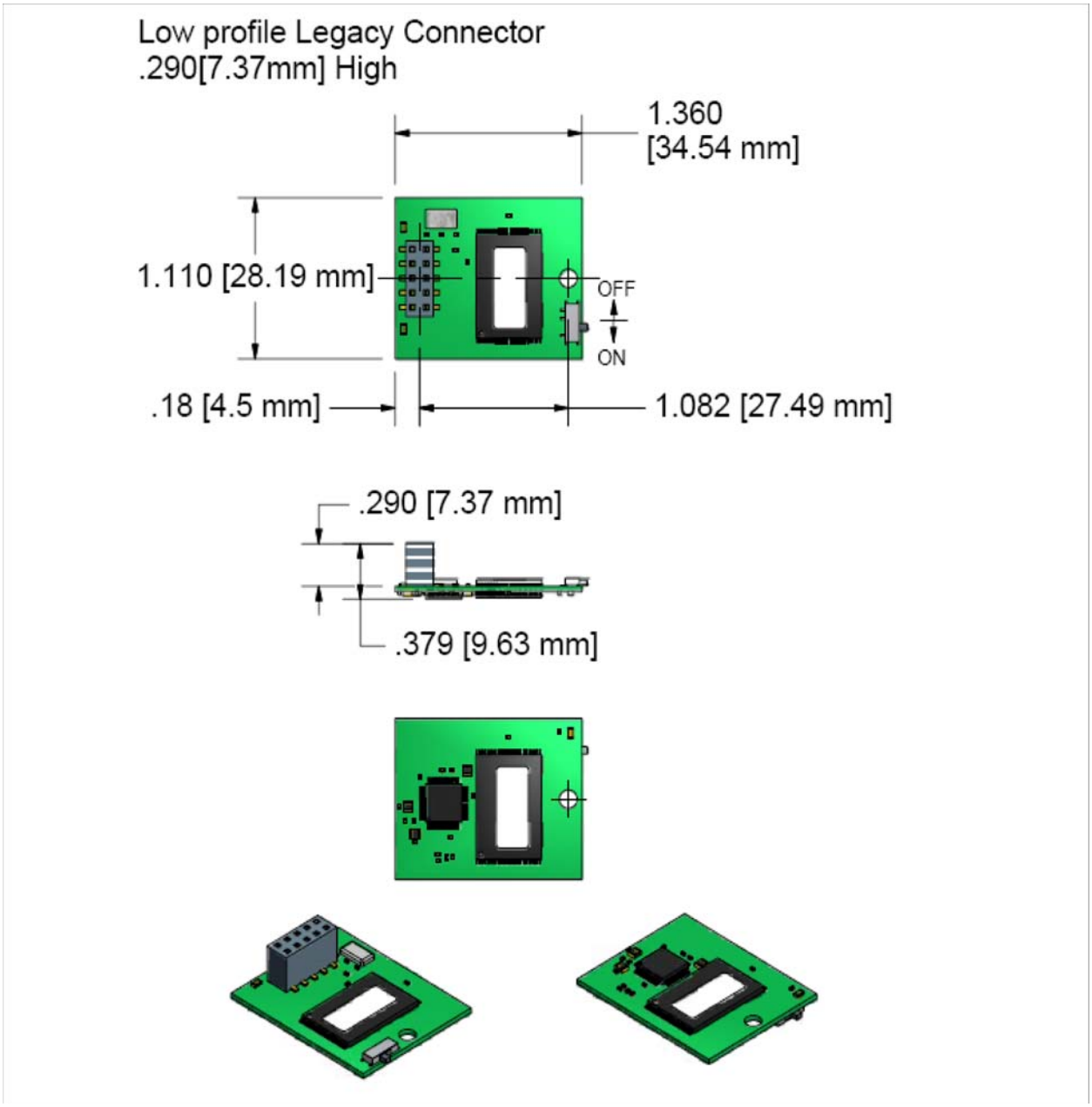


2.2.3 Horizontal Mounting

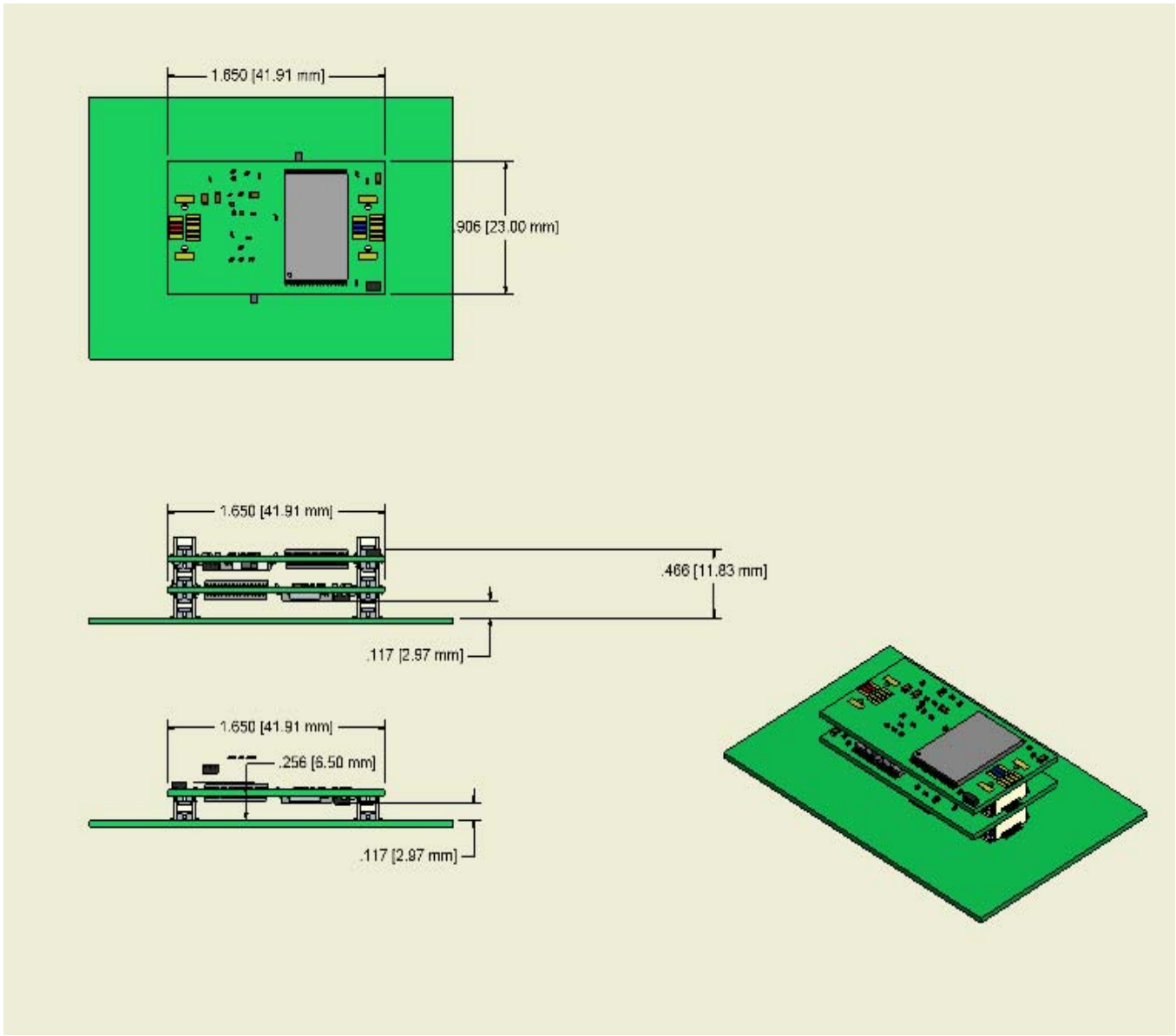
Legacy Connector:



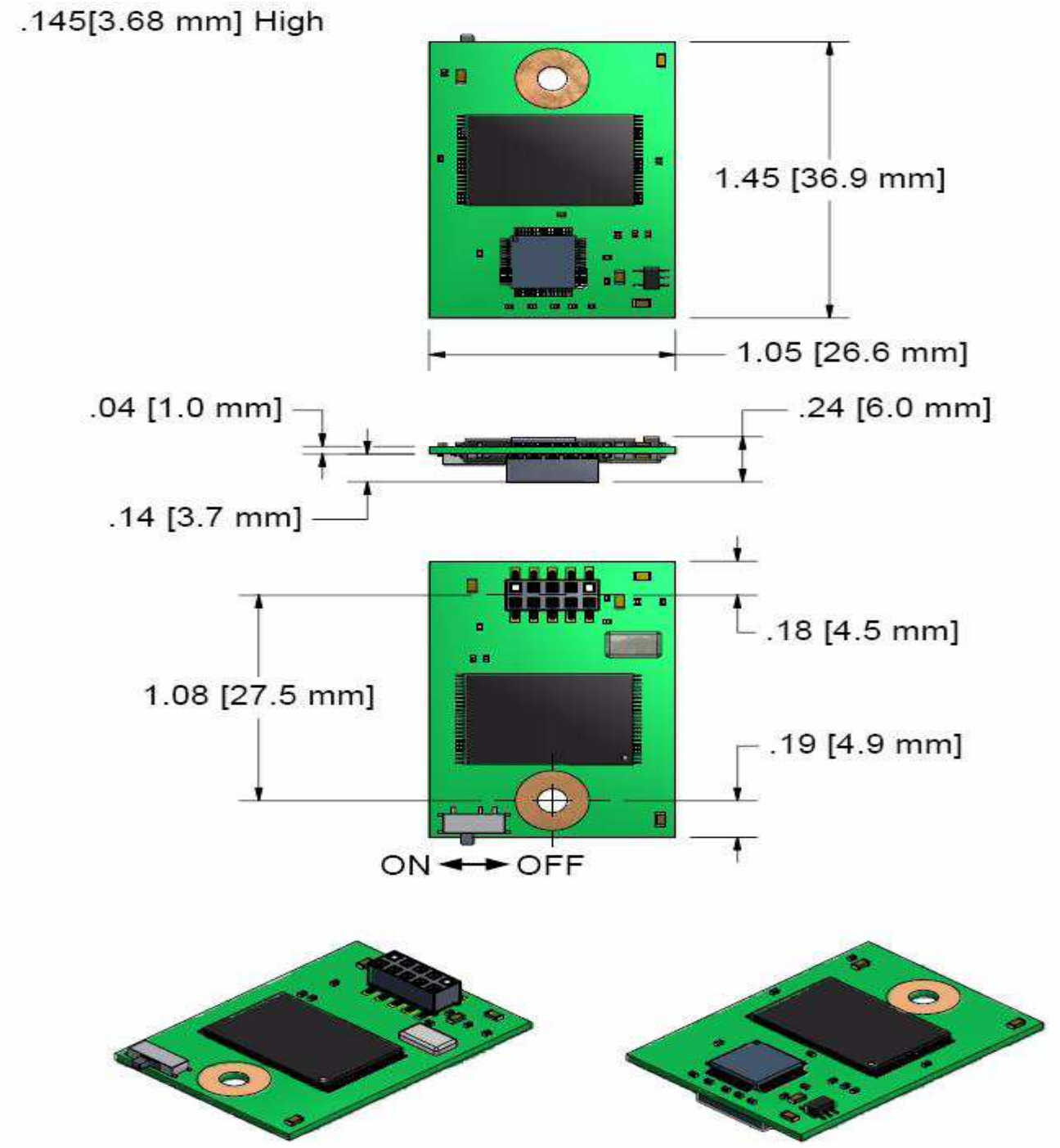
Low Profile Legacy connector:



Stacking Connector:

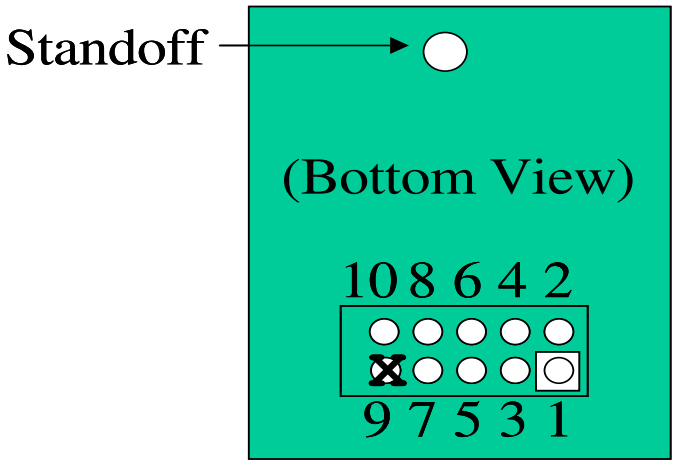


2mm Low Profile Legacy connector:



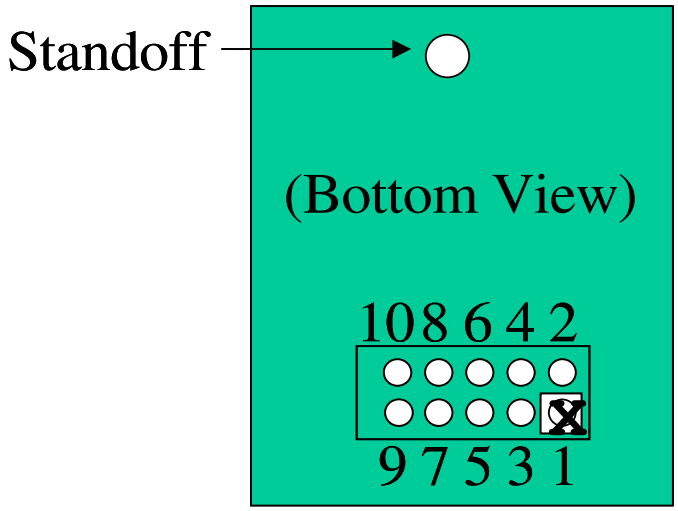
2.2.4 Connector Pinout

Legacy Connector, 5V:



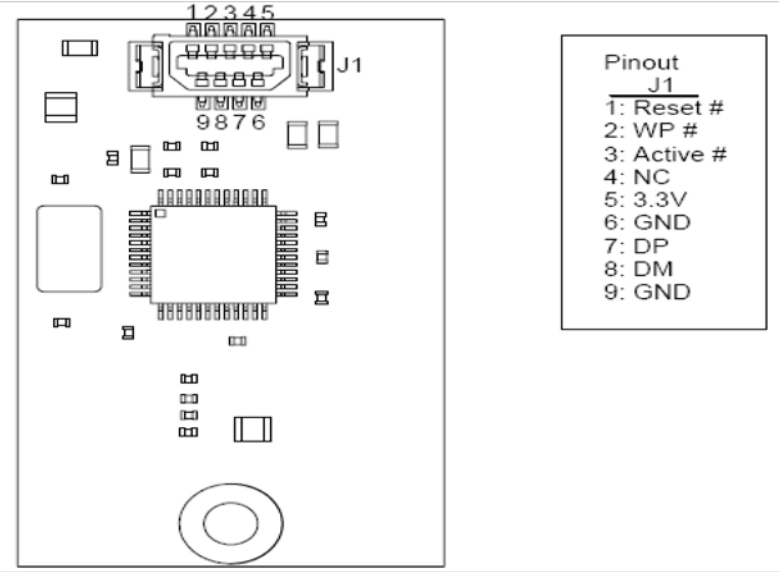
1: +5V
2: No Connect
3: Data –
4: No Connect
5: Data +
6: No Connect
7: GND
8: No Connect
9: Key
10: No Connect

Legacy Connector, 3.3V:

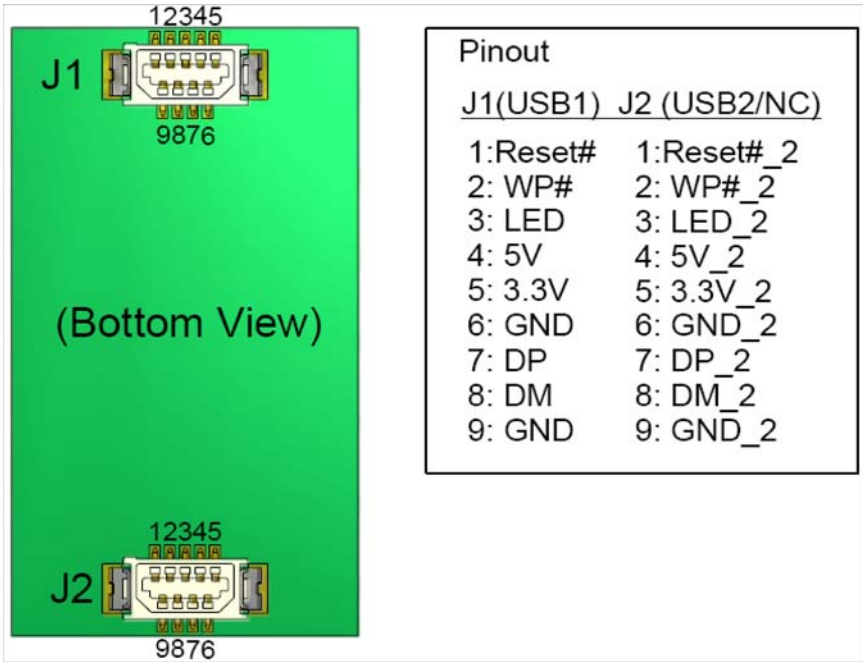


1: Key
2: No Connect
3: Data –
4: No Connect
5: Data +
6: No Connect
7: GND
8: No Connect
9: +3.3V
10: No Connect

Standoff Connector:



Stacking Connector:



2.2.5 Host Connector and Pinout

Legacy Connector

The embedded USB drive uses a .1" pitch 2x5 pin header that is keyed to the voltage of the board. The 3.3V board will have position 1 blocked and the 5V board will have position 9 blocked. The connector on the host must be keyed correctly to avoid damage to the board. The header on the host may be any .1" pitch 2x5 header with .025sqin posts with the appropriate position removed for keying. For example a **Samtec P/N TSW-105-23-F-D-009** is the appropriate part number to for the 5V board. **P/N TSW-105-1-23-F-D-001** is the appropriate part number for the 3.3V board.

For the Legacy Short Connector, the header on the host shoudl be TMM-105-S-D-009

Standoff

The Legacy Connector Drive uses a standoff that can be screwed or locked onto the host board. The mounting hole on the host board should be 0.125 inches in diameter to accommodate a screw or locking pins and should be spaced as indicated on the diagram in section 2.2.1. The low profile versions do not come with a standoff.

Stacking Connector

The SMART eUSB Drive with the stacking connectors is designed for applications where low mounted height is important or where a second drive is needed. The stacking drive comes in two configurations: Top or Bottom. If only a single drive will be used on a system, use the Top configuration. In this configuration, J1 is used to connect the power and USB signals between the host and the drive. J2 is used only for board support in this configuration and will not use any signals on this connector.

If board stacking is to be used, a Bottom drive and a Top drive can be used together. Each will have its own independent USB bus and appear as a seperate drive. The Bottom drive is the same as the top drive, except that it has additional headers mounted on top of it to connect with a second drive. On the Bottom drive, J2 and J3 are used to pass the second USB bus up to the Top board. J4 is a dummy header used for supporting the Top board and does not contain any signals.

The Stacking Connector drives contains two Hirose DF9, 9Pin, 1mm pitch, friction locking, SMT receptacles for connecting to the host. The part number for this part from Hirose is:
DF9B-9S-1V
The mating part for use on the host may be any of the following Hirose Part numbers:
DF9-9P-1V (with metal fitting, with boss)
DF9B-9P-1V (with metal fitting, without boss)
DF9A-9P-1V (without metal fitting, with boss)
DF9C-9P-1V (without metal fitting, without boss)

Both 5V and 3.3V are shown on the connector but only one is necessary. If the 3.3V drive is being used only 3.3V needs to be connected on the host. If the 5V drive is being used only 5V needs to be connected on the host. To be able to use either drive connect both power lines on the host.

Two optional signals are brought out to pins 1 and 2 of the connector. If these signals are not used by the host, these pins must be left unconnected.

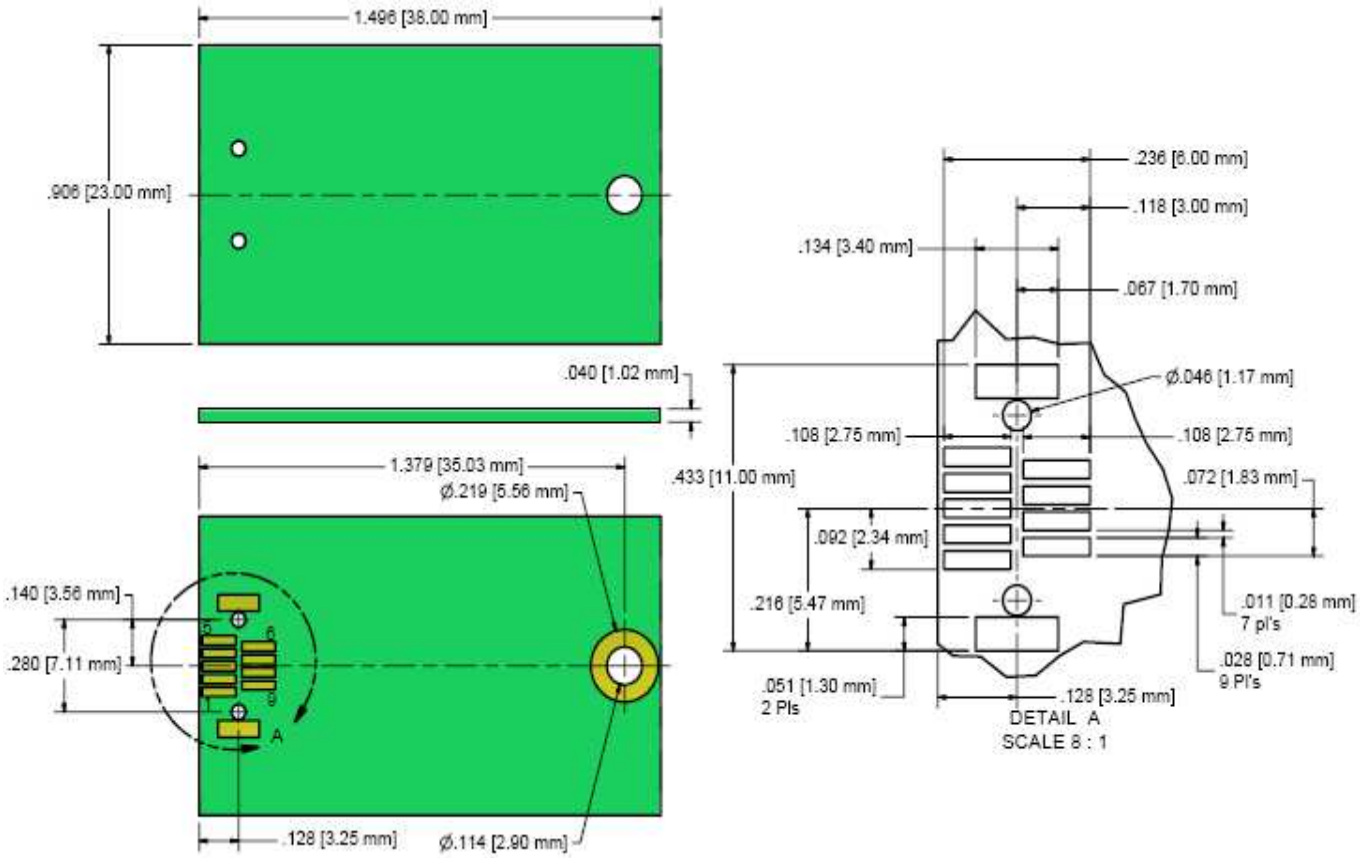
Pin 1, Reset#, may be used by the host to apply a hardware reset to the drive. This reset signal is a 3.3V active low signal. The host may pull this signal low to force a reset to the drive controller. At all other times (including during power up) the host must present a high impedance to this signal. Reset# is pulled up to 3.3V on the drive

Pin 2, WP#, may be used by the host to write protect the drive. This signal is a 3.3V active low signal that is shared between the host and the switch (if present) on the USB drive. The host may pull this signal low to write protect the drive. At all other times the host must present a high impedance to this signal. WP# is pulled up to 3.3V on the drive. The switch and this pin are logicallay OR'd- if either are set, the drive will be write protected.

Stacking Connector cont.

Pin 3, LED, is a 3.3V 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 ? has a 4mA drive strenght

2.3.2 Board Dimensions- Short eUSB Drive W/Standoff



2.3.4 Horizontal Mounting - Short eUSB Drive W/Standoff