

HTFLASHEVM User's Guide

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1 Overview

The HTFLASHEVM is designed for verification of the SM28VLT32 in extreme environments. The EVM, as shipped, is ready for test up to 200°C with the following exceptions. The decoupling capacitors need to be swapped from standard temperature range to 200°C rated through-hole components. This was done to save board cost on systems only needing room temperature protocol development. Alternate BOM data is provided for acquiring appropriate 200°C capacitors for in oven testing. Additionally, the plastic separators for the installed pins should be removed before exposing entire board to oven temperatures.

The EVM provides 100-mil berg type pins for access to SPI control pins (CS#,SO,SI,SCK), FLCLK, WP#, HOLD#, and power. Additionally, a footprint for an oscillator is present on the layout to allow the population of a standalone 12-MHz or slower oscillator.

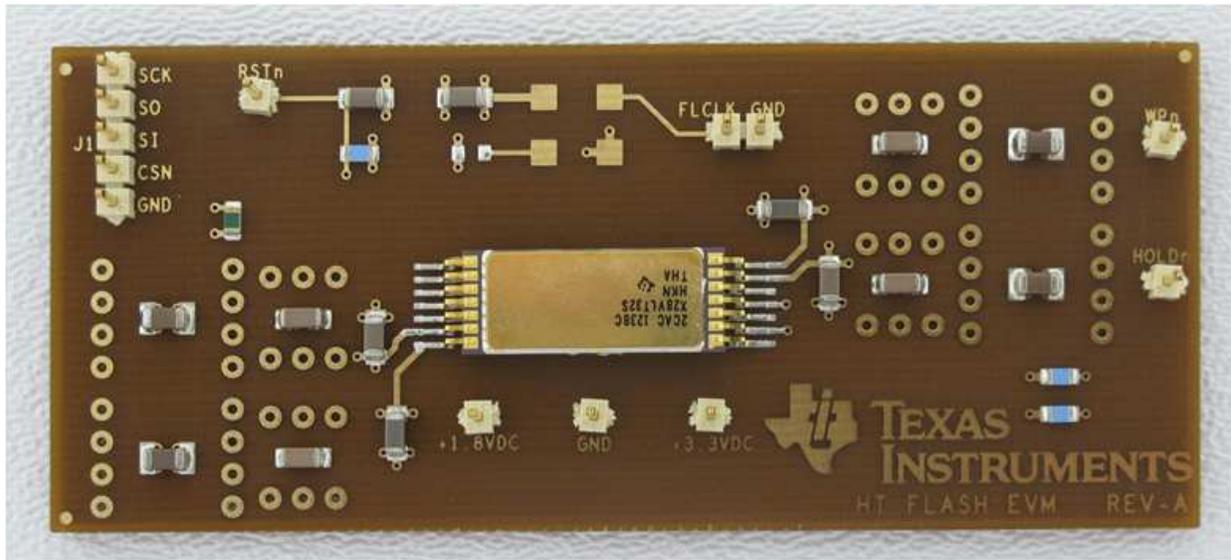


Figure 1. HTFLASHEVM

2 Setup and Required Equipment

The EVM has a software GUI that is designed to interface to a TotalPhase Cheetah SPI hardware adapter. The Cheetah SPI host adapter is not provided, but can be obtained from TotalPhase: http://www.totalphase.com/products/cheetah_spi/.

Additionally, a flying lead set will also be needed (low temperature operation only). Custom flying leads will need to be created for in oven testing. The flying lead set can also be ordered from TotalPhase: http://www.totalphase.com/products/split_cable/.

The software GUI can be downloaded and installed from the SM28VLT32-HT product folder.

The EVM can be interface without the Cheetah or the use of the TI SM28VLT32-HT GUI. In this case, connections can be made based on the SPI host adapter. Follow instructions provided with Cheetah host adapter for proper installation.

2.1 Software GUI installation

Execute setup.exe and follow these instructions:

Select default location or other if desired and press Next.

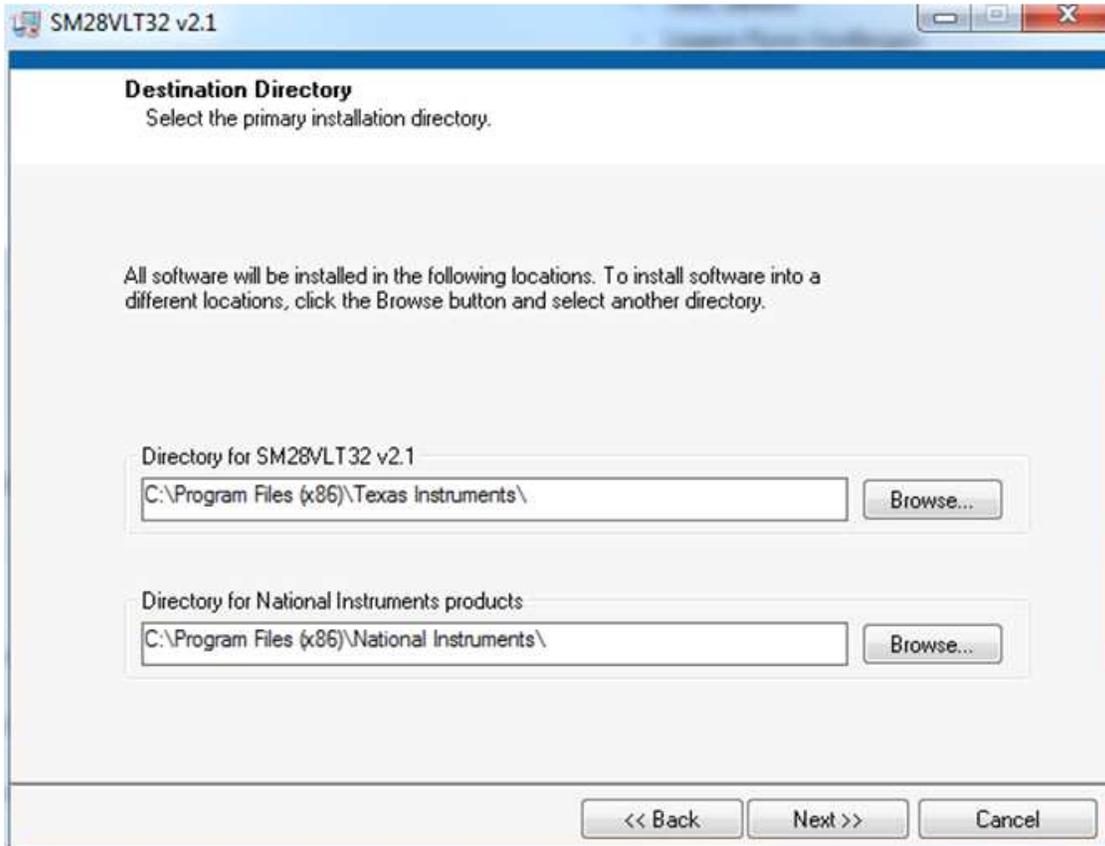


Figure 2. Destination Directory

Select "I accept the License Agreement" and press Next to continue.

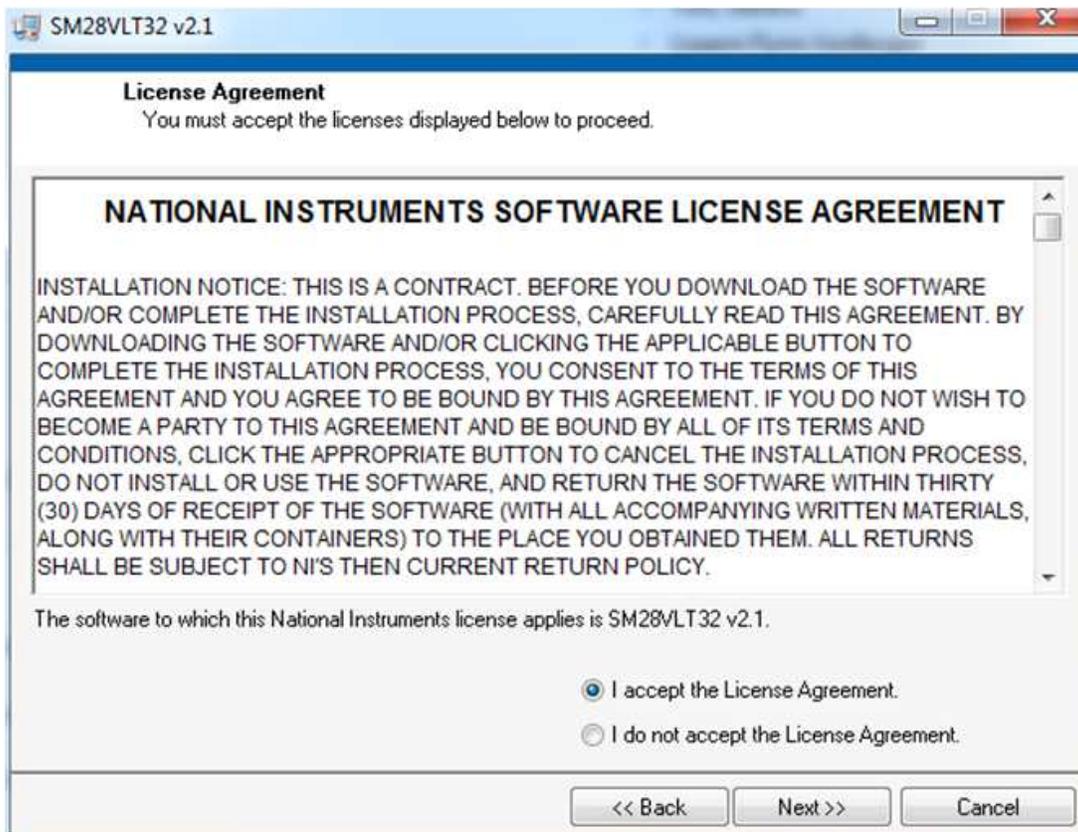


Figure 3. License Agreement

Press Next to begin the installation.

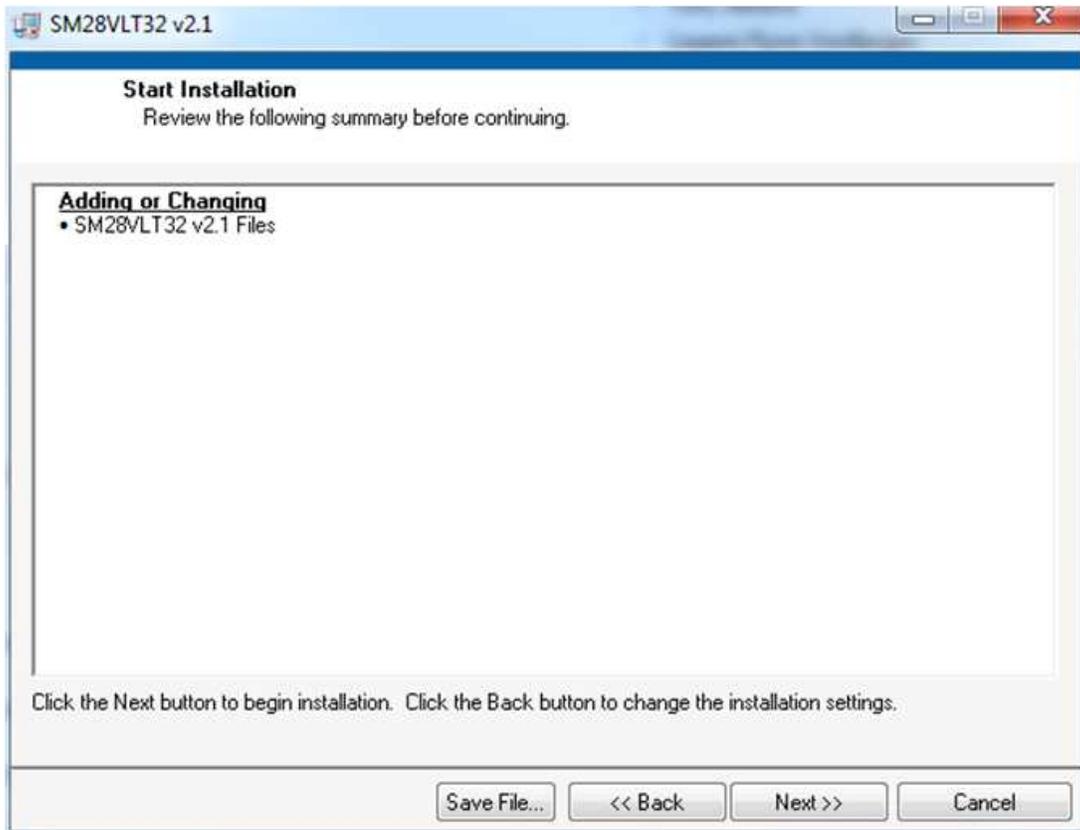


Figure 4. Start Installation

Press Finish.

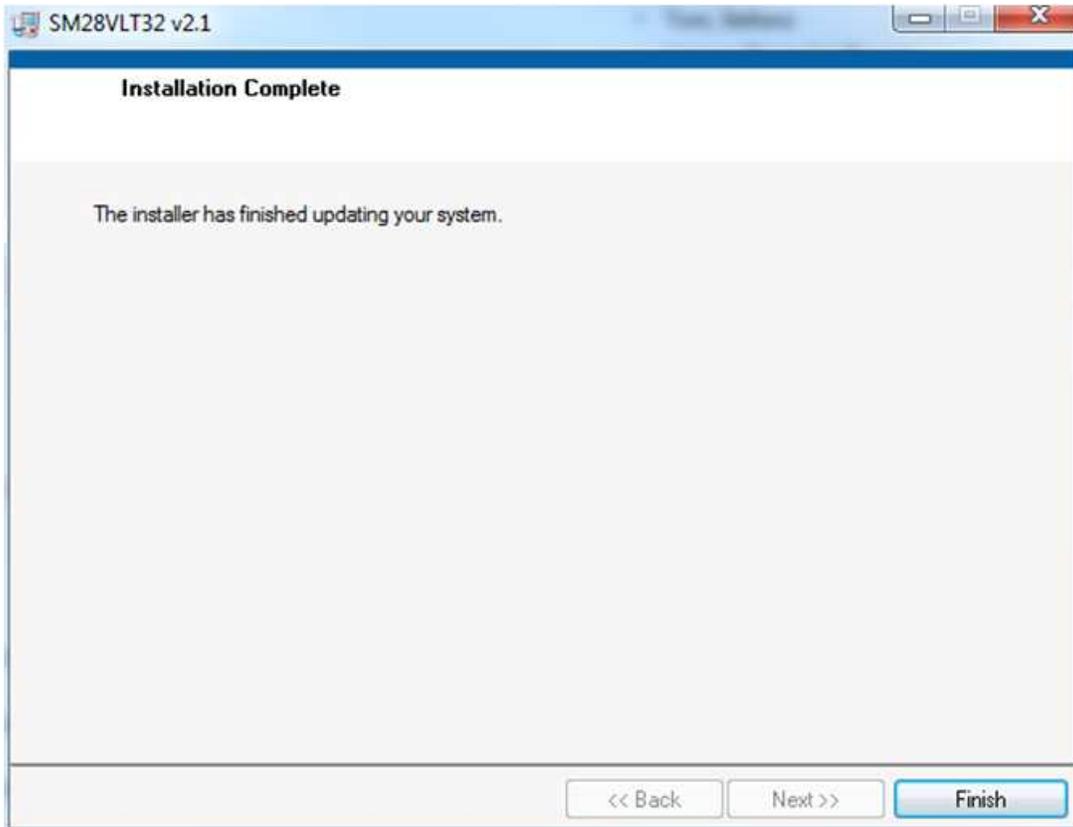


Figure 5. Installation Complete

After restarting your computer the GUI is ready to use.

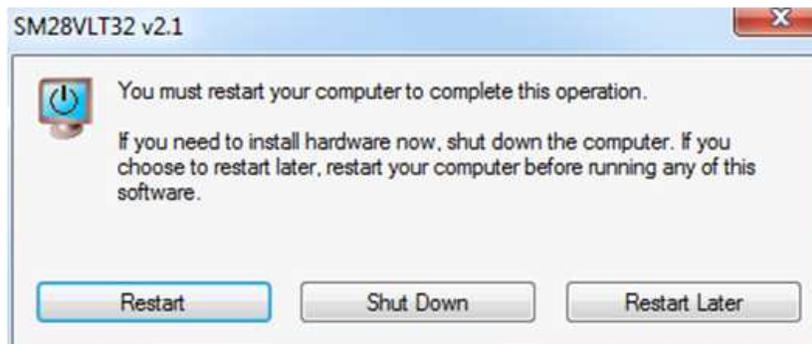


Figure 6. Restart

2.2 Connections

From the flying lead set, make the following connections:

- SCL → RST#: This is device reset.
- GND → GND
- MISO → SO: Device SPI slave output
- SCLK → SCK: SPI clock
- MOSI → SI: Device SPI slave input
- SS/SS# → CS#: Device Chip Select

With supplies disabled, make the following power connections:

- Connect 3.3-V supply to 3.3-V VCCIO power. Can be current limited to 100 mA.
- Connect 1.8-V supply to 1.8-V Vcore power. Can be current limited to 200 mA.
- Connect GND to common ground for both supplies.
- Connect 12-MHz clock to FCLK pin. Do not enable yet.
- Power VCORE, then V_{CCIO}. VCORE and V_{CCIO} can also be brought up simultaneously as RST is held low through RC time constant. If VCCIO is brought up first, RST# must be held low until VCC has exceeded 1.65 V. See datasheet for full specification of power sequence requirements.
- Enable FCLK.

Current on board should read approximately 120 mA on VCORE and 16 mA on VIO.

3 Using the SMV28VLT32-HT GUI

Each of the following sections will describe various attributes and capabilities of the GUI.

3.1 GUI Info

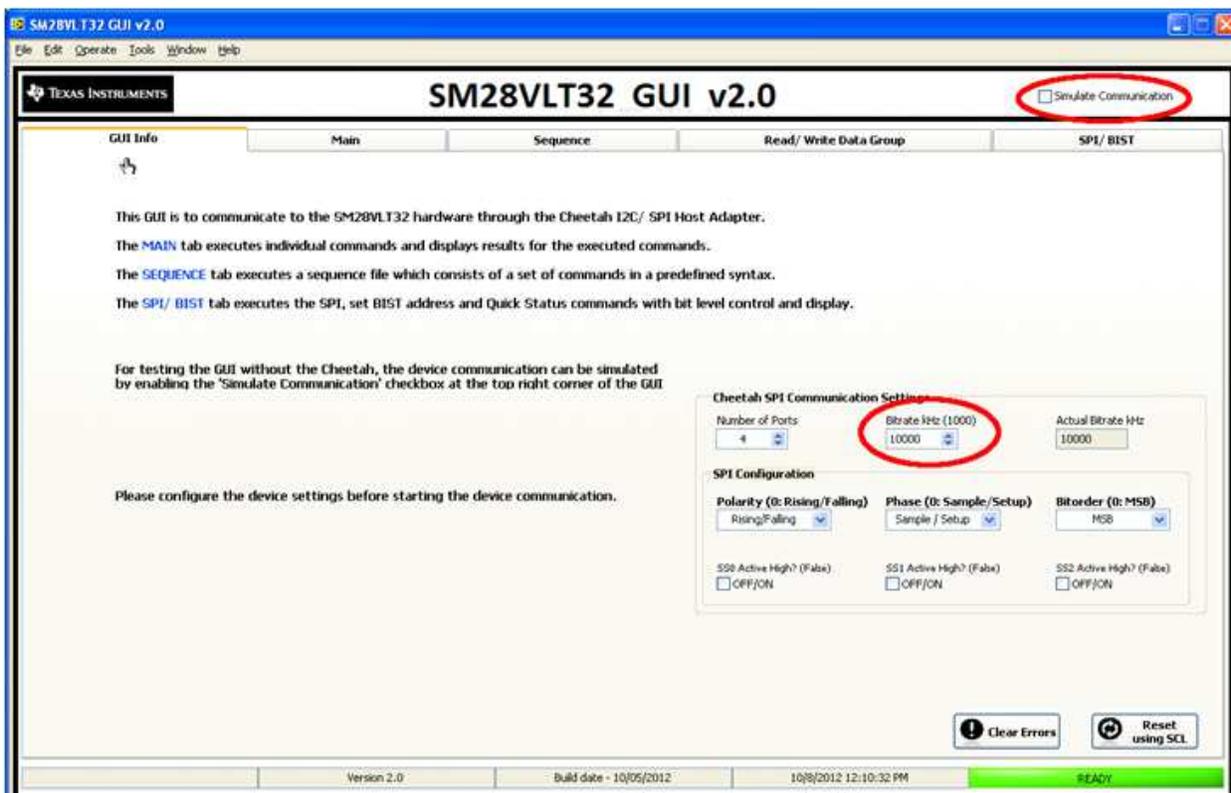


Figure 7. GUI Info Tab

Put GUI in hardware mode by deselecting the Simulate Communications check box.

All other settings are correct. Note that the SPI frequency can be changed. The max frequency for SPI clock is 10 MHz and is associated with 12-MHz FCLK. If FCLK is running slower, then SPI clock will need to be less than or equal to 5/6th of FCLK. If FCLK is slower, refer to the datasheet section, Provisions for Operating FCLK at Frequencies Less than 12 MHz.

3.2 Main

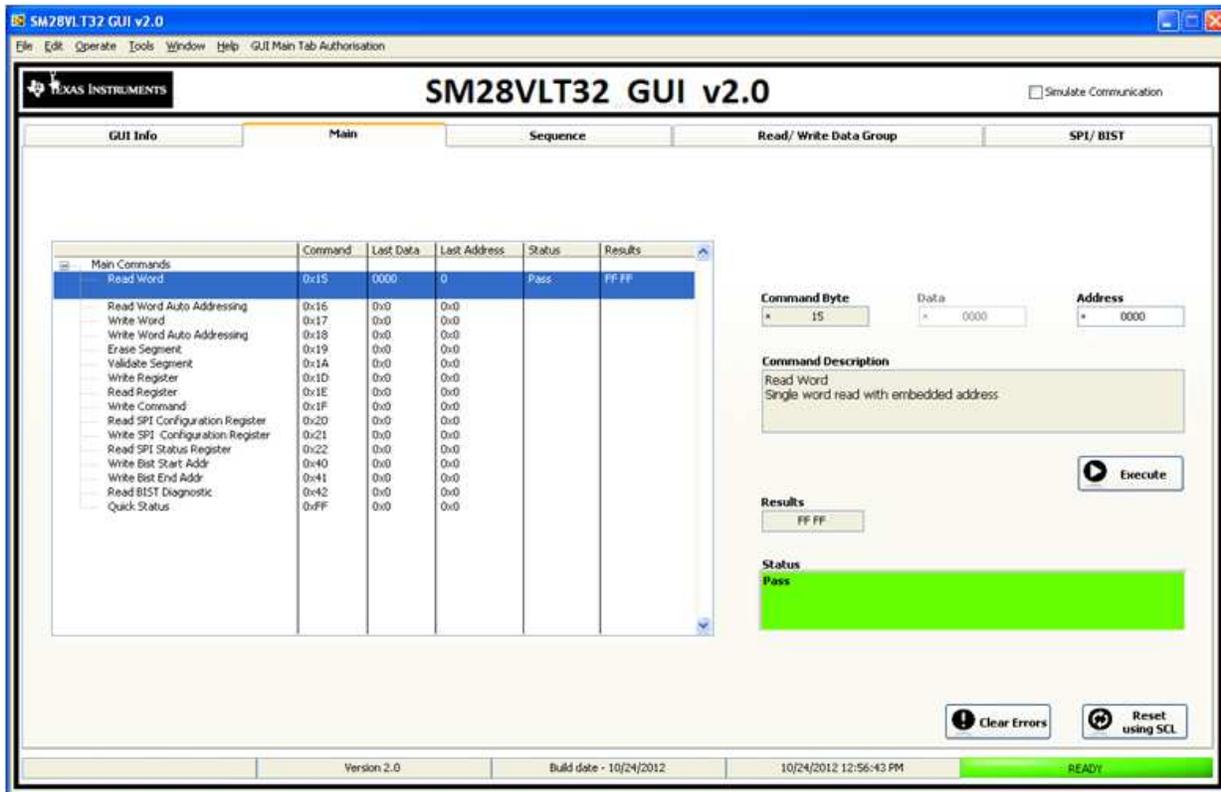


Figure 8. Main Tab

The Main tab has the ability to run any single command that the device supports as a single command. Note that some of the commands above are either not supported or intended only for factory use.

Selecting the command on the left will enable the dialog boxes on the right for that particular command. In the above case, Read Word is selected with 0000 in address. Pressing execute will return the value read from address 0.

Supported commands:

Read Word, Read Word Auto Addressing, Write Word, Write Word Auto Addressing, Erase Segment, Validate Segment, Write Register, Read Register, Write Command, Read SPI Configuration Register, Write SPI Configuration Register, Read SPI Status Register, and Quick Status.

These commands are defined and explained in more detail in the device data sheet.

3.3 Sequence

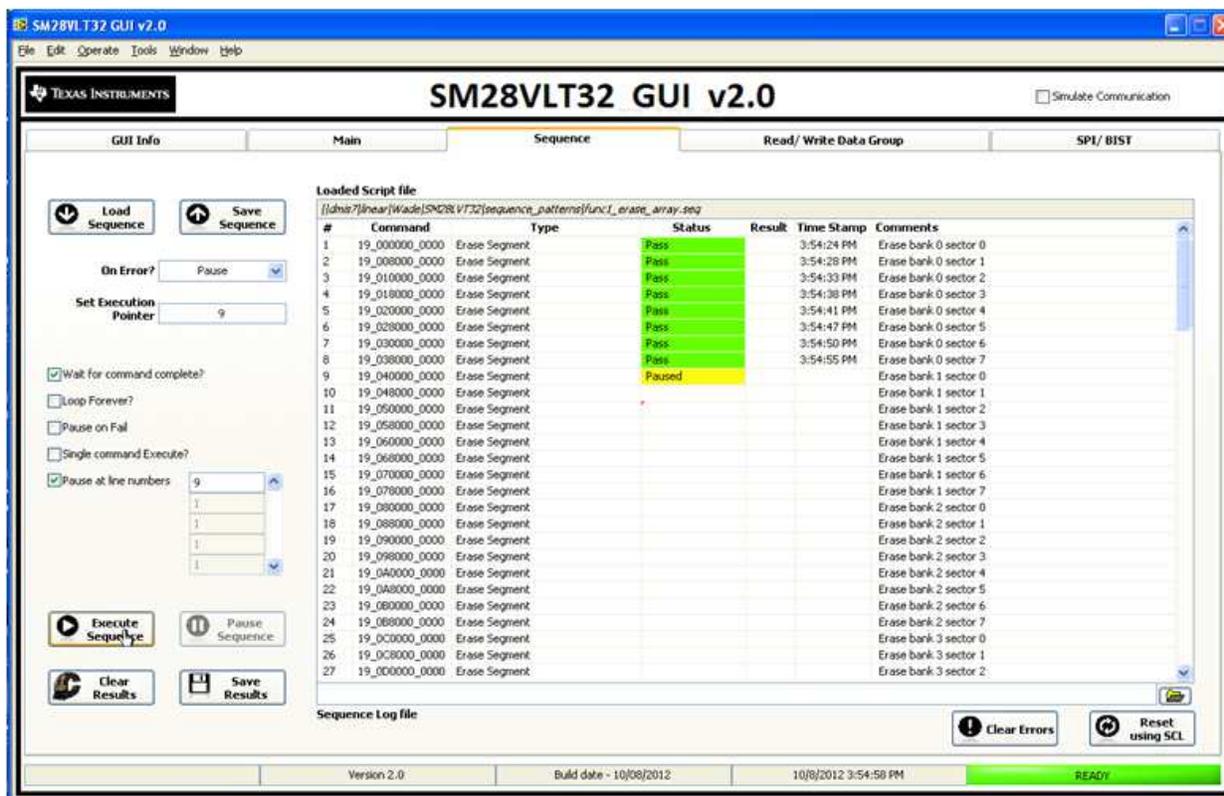


Figure 9. Sequence Tab

The Sequence tab is perhaps the most powerful part of the GUI. The GUI implements what is called a sequence file. This file represents a pseudo command with address and data. In the screen shot above, a sequence file is loaded that executes erase segment commands.

Most functionality of this GUI is self-explanatory. Options are defined as follows:

On Error?—Determines what functionality should be executed if an error occurs. This can be pause, Clear and Resume, or Ignore.

Set Execution Pointer—Sets the execution pointer to any line number, so part of the sequence can be skipped if necessary.

Wait for command complete?—Turns on a polling mechanism that will query the flash to determine if the last command completed and if completed without error. This is valid for writes and erases. Executing an erase with this unchecked will cause issues with some commands not being executed. This is due to the fact that both writes and erases take time to complete. This does not affect reads.

Pause on Fail—Halts the execution if a failure or error is detected. Pressing Execute Sequence will resume the execution.

Single command Execute?—Executes only one line at a time at each press of the Execute Sequence button.

Pause at line numbers—Allows the sequence to execute up to a line number and pause. Pressing Execute Sequence will resume the sequence.

Clear Results—Resets execution pointer to 1 and will clear all the results.

Clear Errors—Executes a sequence “1F 00 40 xx” This is a special command that will clear internal device errors such as a command error or invalid data error. See datasheet for further description of these two errors that require manual intervention to clear.

Reset using SCL—Asserts the SCL line active low, then back high. If this is connected to the RST line, then it can automate resetting the flash device.

Near the bottom of the screen is a blank line with a folder browse dialog to the right. This is a file logging option. If a file is entered here, the results will be written to a file. The Sequence File has the following format:

```
CC_AAAAAA_DDDD // Comment
```

Where CC is the hex value of the command, AAAAAA is the address, and DDDD is the data.

In the case of a read (register or address), the DDDD represents the expected value of the read. In this way, a test can be created to write and read data to the array or configuration registers with validation.

The RESET command is an additional command that is implemented. This single word command will cause the GUI to assert RST (via SCL) low and then resume back high.

It is useful to note the distinction between an error and a fail. Errors are reported by the device, such as Command Error or Invalid Data. The GUI will report fails if a read of an address or register does not match its expected value. The Clear Errors button only impacts the first two device errors. An error does not represent a fail in the GUI logic. A fail is a logical mismatch between an expected value for a read and the actual read value.

The Sequence file has some practical restrictions due to the nature of hardware and software implementation. It needs to be limited to approximately 1000 lines. Exceeding this causes progressively slower performance. Reading and writing large portions of the array should use the Read/Write Data Group tab.

Some example sequence files are provided for reference under the `sequence_patterns` directory.

3.4 Read/Write Data Group

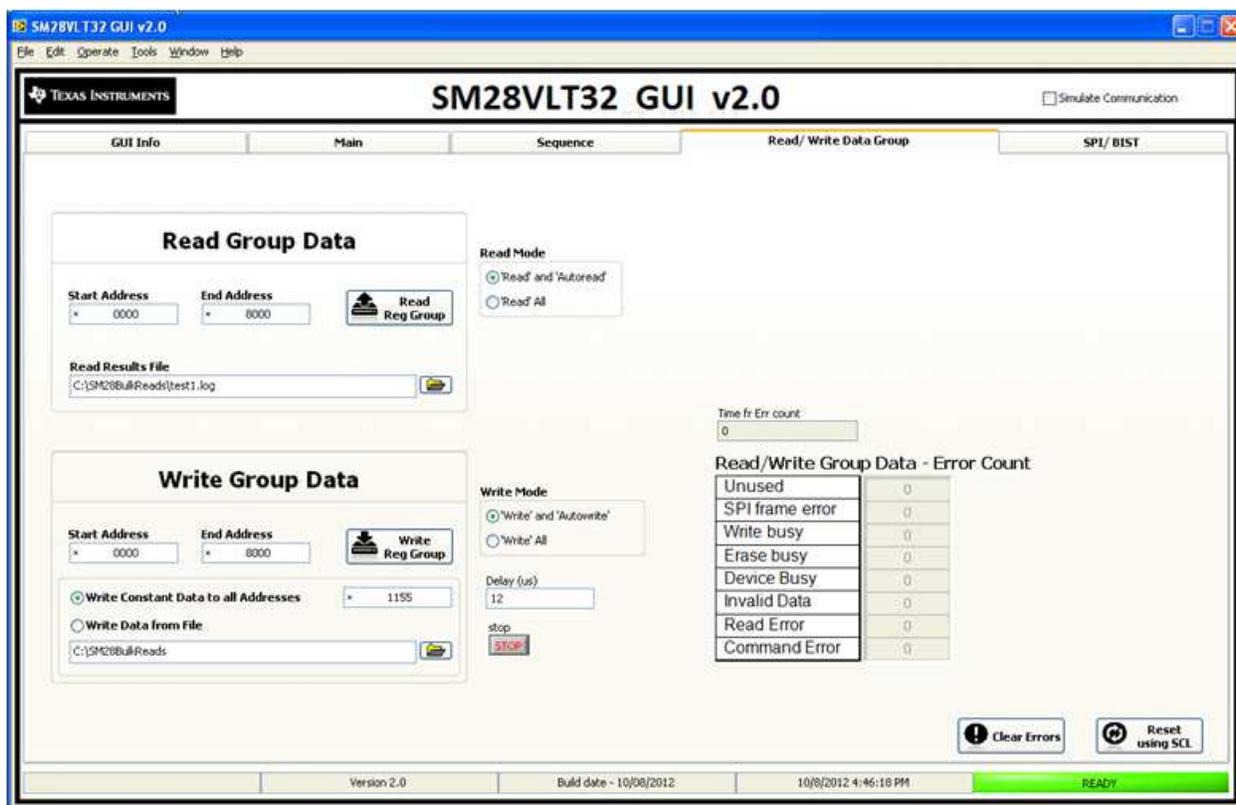


Figure 10. Read/Write Data Group Tab

The Read/Write Data Group tab takes advantage of building transactions for the Cheetah hardware that can be streamed to the device. This prevents USB latency issues from dramatically impacting performance if commands were individually framed for transfer.

The Read Group Data is very self explanatory. Pressing Read Reg Group will build the transactions for the entire address range utilizing the read command (and the read with autoread if selected) then send these to the device. The GUI will record the results to the file indicated.

The Write Group is similar, with one added complexity. The nature of a flash write is such that the duration of the write is not known and varies. To accommodate this, a delay variable is entered that allows the delay to be set between each transaction. The typical max delay at room temperature is 50 μ s. In most cases, this will be sufficient time to complete the write before the next write is submitted. If shorter durations are used or if some addresses require longer than the delay setting, then an error will be observed. This is post-processed information as the transactions are built and sent as a stream. The PC/GUI cannot interact with the device quick enough on the fly. If there are errors, then you will be able to see the cumulative count of these in the dialog boxes on the right. Note that most addresses will actually program in about 8 μ s at room temperature. Unfortunately, the GUI and hardware are not capable of polling the device for completion at this speed. This is due to overhead associated with windows and USB bus transactions.

3.5 SPI/BIST

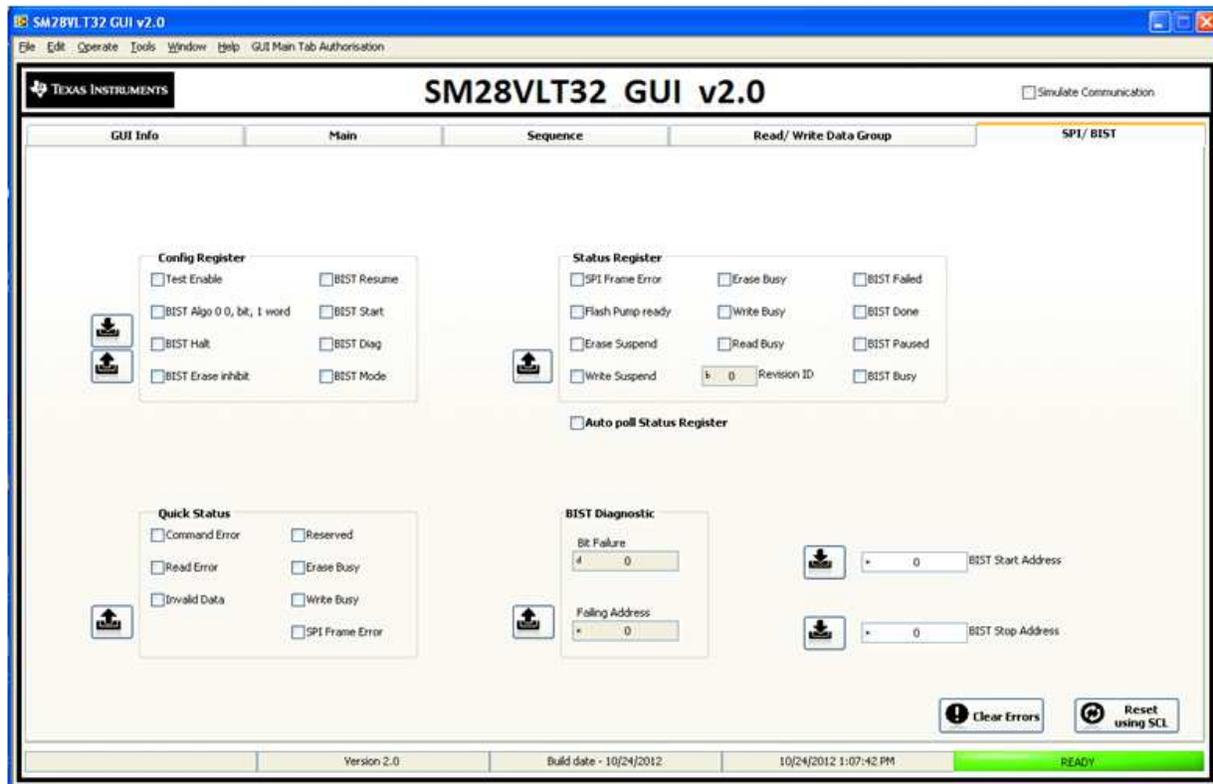


Figure 11. SPI/BIST Tab

The SPI/BIST tab contains interactive views of the configuration register, the quick status results, the status register, and BIST diagnostics.

The SM28VLT32-HT is capable of running an internal BIST engine for self test at less than full operating temperature. The algorithm includes erase and, therefore, the max temperature of the test must be less than 125°C to prevent over depletion of the array during erase.

Full operation of the BIST engine is not covered in the users guide. However, several sequence file examples are available in the sequence file directory that invoke the necessary register writes to run BIST. Note the device must be reset after a BIST run to enter normal operation mode.

4 Board Layout

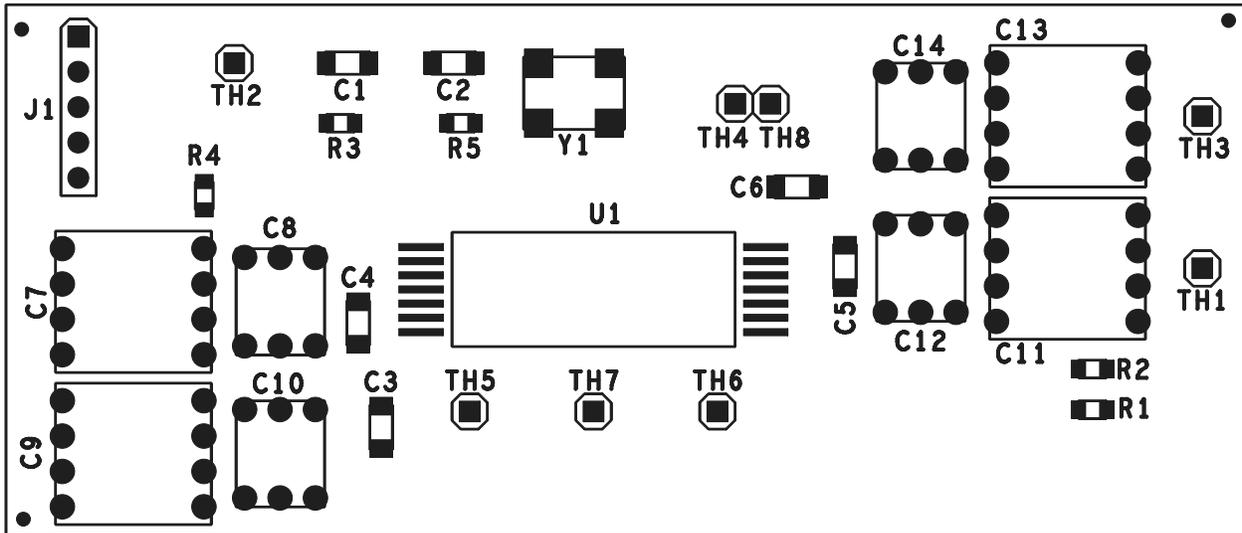


Figure 12. Assembly

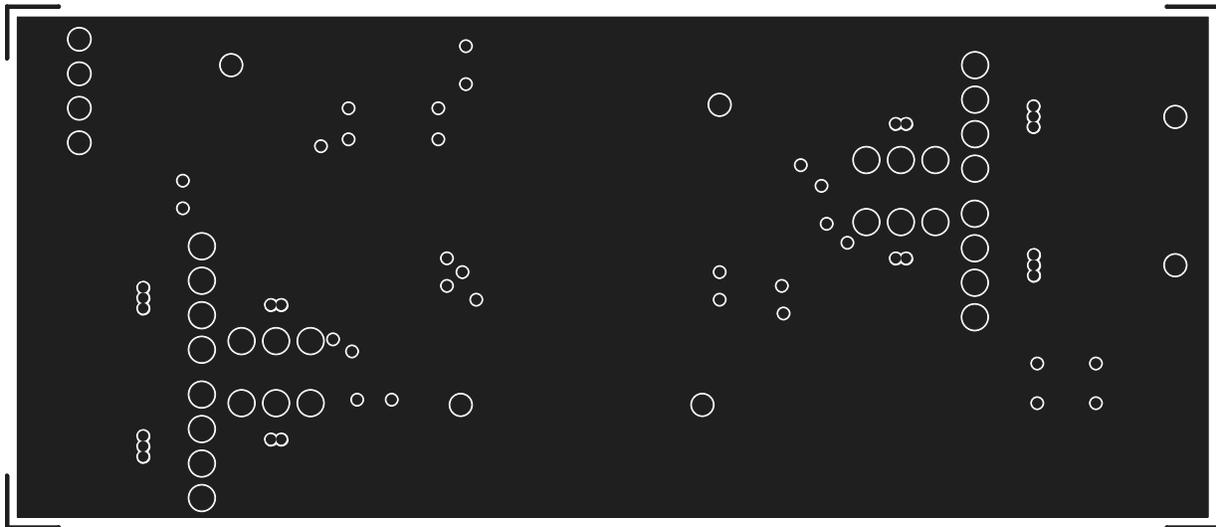


Figure 13. Top Layer

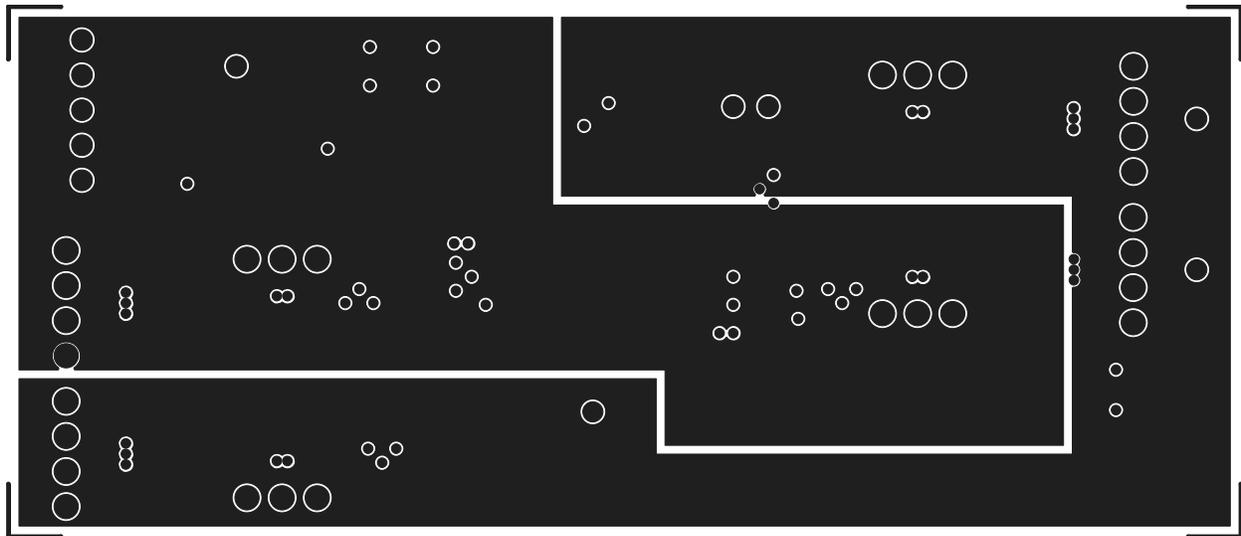


Figure 14. Power

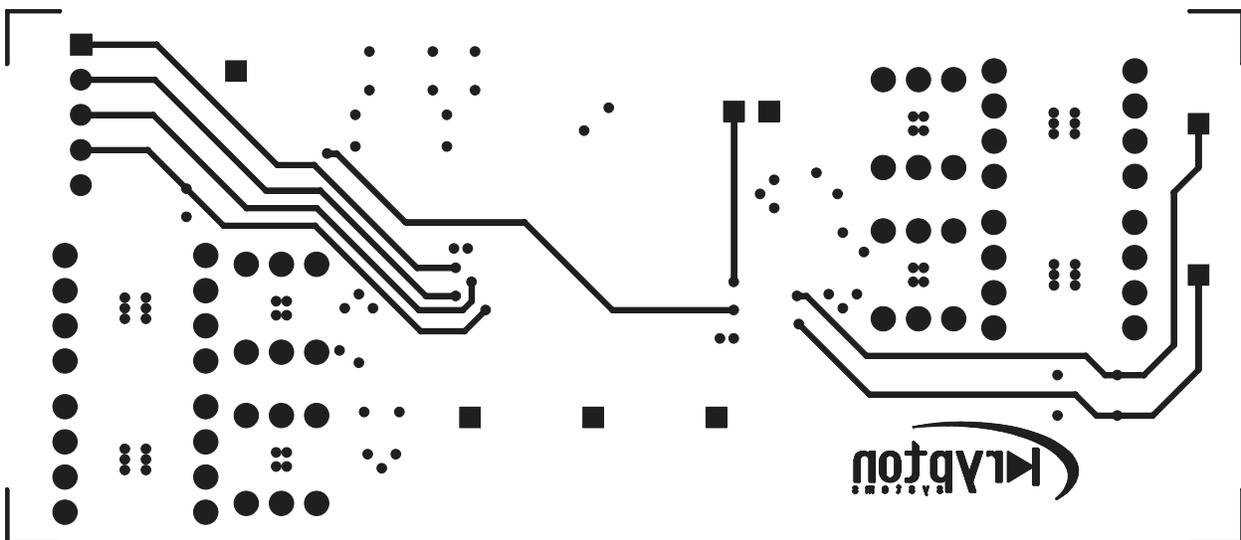


Figure 15. Bottom Layer

5 Schematic and Bill of Materials

The following pages contain the HTFLASHEVM schematic and bill of materials.

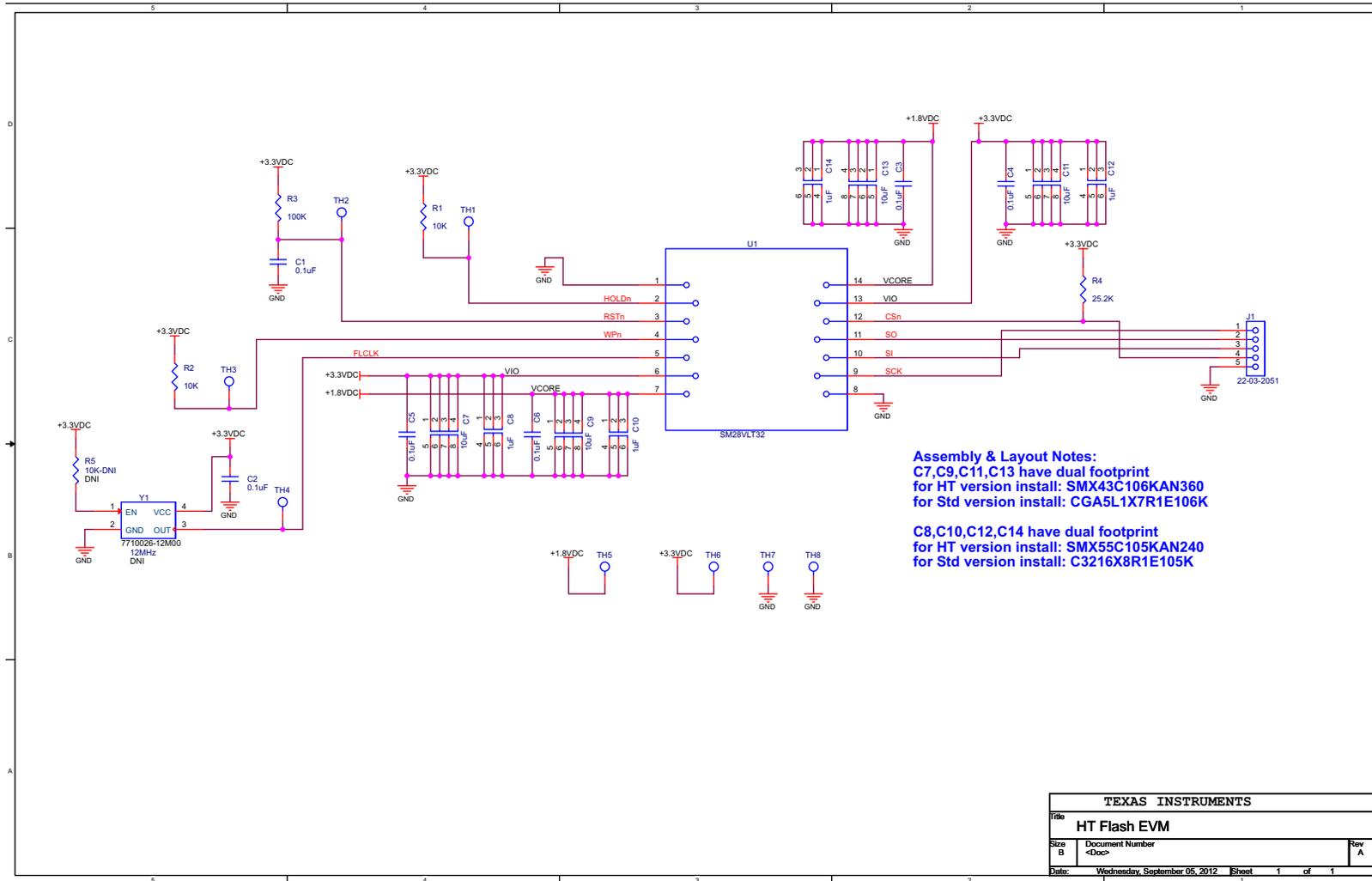


Figure 16. HTFLASHEVM Schematic

Table 1. HTFLASHEVM Bill of Materials

Item No.	Qty	Designator	Value	Manufacturer	Part No.	PCB Footprint
1	6	C1, C2, C3, C4, C5, C6	0.1uF	Kemet	C1206H103J5GACTU	1206
2	4	C7, C9, C11, C13	10uF	TDK	CGA5L1X7R1E106K	1206
3	4	C8, C10, C12, C14	1uF	TDK	C3216X8R1E105K	1206
4	1	J1	22-03-2051	Samtec	HTSW-150-08-G-S	HDR_THVT_1x5_100
5	2	R1, R2	10K	Vishay	PLTT0805Z1002QGT5	0805
6	1	R3	100K	Vishay	PHT0805Y1003BGT20 0	0805
7	1	R4	25.2K	Vishay	PLTT0805Z2522QGT5	0805
8	1	R5	10K-DNI	Vishay	PLTT0805Z1002QGT5	0805
9	8	TH1, TH2, TH3, TH4, TH5, TH6, TH7, TH8	TP	Samtec	HTSW-150-08-G-S	HDR_THVT_1x1_100
10	1	U1	SM28VLT32	Texas Instruments	SM28VLT32	CDFP_14_320X800_40
11	1	Y1-DNI	12MHz	Frequency Management Int.	7710026-12M00	XTAL_4_SM_283x204
Alternate HT temperature components for Dual Footprints						
	4	C7, C9, C11, C13	10uF	AVX	SMX43C106KAN360	CAP_THVT_SMX4_440X400_100
	4	C8, C10, C12, C14	1uF	AVX	SMX55C105KAN240	CAP_THVT_SMX3_300X250_100

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As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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