

# ASPEED Ethernet PHY Evaluation Module



## Description

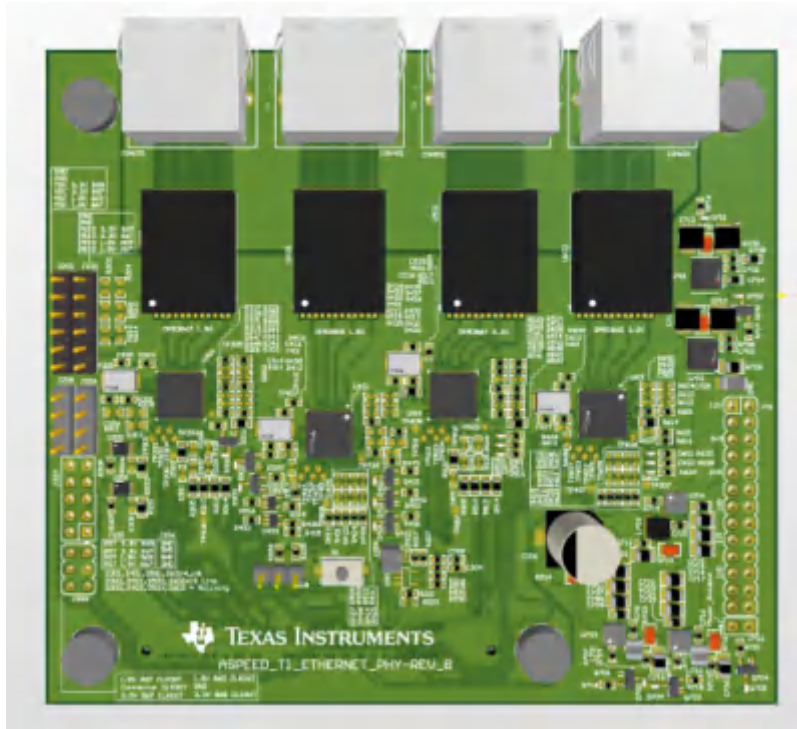
The ASPEED Ethernet PHY EVM is a daughter card intended to connect to ASPEED's AST2600 EVB to show how the DP83867 and DP83869 Ethernet PHYs can be used in a Board Management Controller (BMC) system. The EVM contains four PHYs each capable of 10/100/1000Mbps data rate.

## Features

- RGMII interface for each PHY
- USB2MDIO support
- Support for VDDIO = 1.8V or 3.3V
- Status LEDs:
  - Link Status
  - Link Activity
- Manual reset

## Applications

- Server diagnostic testing
- Server monitoring
- Running mactest utility



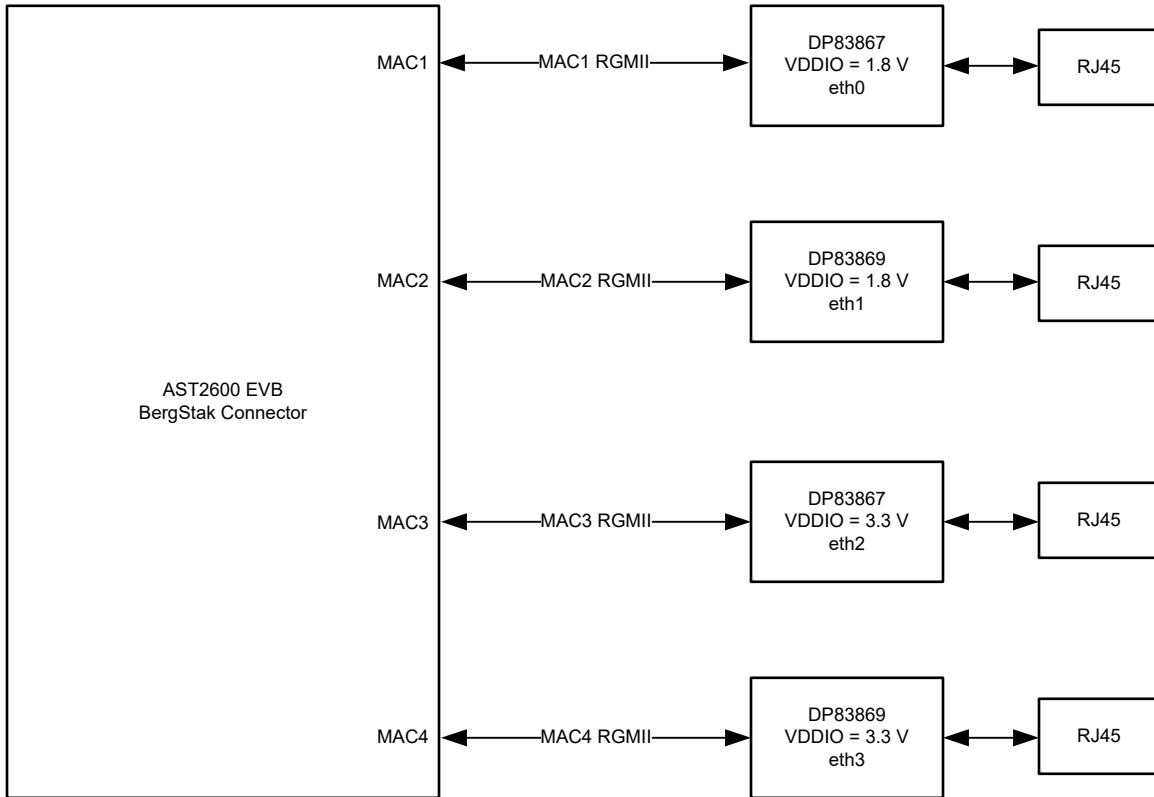
**ASPEED Ethernet PHY EVM Top View**

# 1 Evaluation Module Overview

## 1.1 Introduction

The ASPEED Ethernet PHY EVM helps the user evaluate the features of Texas Instruments' DP83867 and DP83869 in a Board Management Controller (BMC) context. This User's Guide details how to properly operate and configure the EVM. The guide also includes hardware and software setup instructions for the ASPEED AST2600 EVB which the EVM is intended to connect to.

## 1.2 Specification



**Figure 1-1. ASPEED Ethernet PHY EVM Block Diagram**

## 1.3 Device Information

Key devices used in the ASPEED Ethernet PHY EVM are:

- DP83867/DP83869 for 10BASE-Te, 100BASE-TX, 1000BASE-T Ethernet signaling

## 2 Evaluation Tutorial

### 2.1 How to Set Up the EVM

This tutorial assumes the user is connecting the EVM to the ASPEED AST2600 Evaluation Board (EVB).

#### 1. Building the image to flash onto the ASPEED processor

- a. Follow the steps in the README at [this](#) GitHub repository to build the image on a Linux machine.
- b. Also, please consult the README at [this](#) GitHub repository for additional flashing information. Install the packages listed in both README files.
- c. Build the image on your Linux machine.

#### 2. Editing the image

- a. There are a series of steps to modify the default image so it integrates the necessary PHY drivers.
- b. First, open the following file:
  - i. [BUILD\_DIR]/openbmc/build/evb-ast2600/tmp/work/evb\_ast2600-openbmc-linux-gnueabi/u-boot-aspeed-sdk/v2019.04+git/git/drivers/phy/Kconfig
- c. Then, edit the Kconfig file by adding the lines circled below.

```

config PHY_TERANETICS
    bool "Teranetics Ethernet PHYs support"

config PHY_TI
    bool "Texas Instruments Ethernet PHYs support"

config PHY_TI_DP83867
    select PHY_TI
    bool "Texas Instruments Ethernet DP83867 PHY support"
    ---help---
    Adds support for the TI DP83867 1Gbit PHY.

config PHY_TI_DP83869
    select PHY_TI
    bool "Texas Instruments Ethernet DP83869 PHY support"
    ---help---
    Adds support for the TI DP83869 1Gbit PHY.

config PHY_VITESSE
    bool "Vitesse Ethernet PHYs support"
    
```

- d. Second, add the DP83867 and DP83869 driver files to the proper directory.
  - i. Open [this](#) TI-maintained repository and copy the DP83867.c and DP83869.c files.
  - ii. Paste the files in the following directory:
    1. [BUILD\_DIR]/openbmc/build/evb-ast2600/tmp/work/evb\_ast2600-openbmc-linux-gnueabi/u-boot-aspeed-sdk/v2019.04+git/git/drivers/net/phy
- e. Third, edit the Makefile in the U-Boot layer.
  - i. Open the file called "Makefile" in the same directory as the above step.
  - ii. Make the following additions:

```

obj-$(CONFIG_PHY_TERANETICS) += teranetics.o
obj-$(CONFIG_PHY_TI) += ti.o
obj-$(CONFIG_PHY_TI_DP83867) += dp83867.o
obj-$(CONFIG_PHY_TI_DP83869) += dp83869.o
obj-$(CONFIG_PHY_XILINX) += xilinx_phy.o
obj-$(CONFIG_PHY_VITESSE) += vitesse.o
    
```

- f. Fourth, change the U-Boot layer defconfig file.
  - i. First, open the following file:
    1. [BUILD\_DIR]/openbmc/build/evb-ast2600/tmp/work/evb\_ast2600-openbmc-linux-gnueabi/u-boot-aspeed-sdk/v2019.04+git/git/configs/evb-ast2600\_defconfig
  - ii. Then, add the following lines to the file:



```

TI DP83867 1e650000.mdio-1:00: ti,rx-internal-delay must be specified
TI DP83869 1e650008.mdio-1:00: attached PHY driver <mii_bus:phy_addr=1e650008.mdio-1:00
TI DP83867 1e650010.mdio-1:00: attached PHY driver <mii_bus:phy_addr=1e650010.mdio-1:00
TI DP83869 1e650018.mdio-1:00: attached PHY driver <mii_bus:phy_addr=1e650018.mdio-1:00

```

- c. If the drivers have been properly bound, the user can begin basic testing.

## 2.2 EVM Evaluation

### 1. Ping Test

- a. To perform a ping test, connect the Ethernet port on a PC to one of the Ethernet ports on the EVM.
  - i. This PC can be the same one that is connected to the ASPEED EVB through the Tera Term console.
  - ii. Make sure the static IPv4 address of the PC is the same as the IPv4 address of the EVM's chosen Ethernet port, except for the subnet of each address.
    1. For example, if your PC IPv4 address is 169.254.206.64 then the EVM's IPv4 address could be 169.254.206.65
  - iii. To change the IPv4 address of a specific PHY, run the following command in Tera Term:
    1. `ifconfig eth0 [IPv4_ADDRESS]`
    2. Note: the above command affects eth0 (the name assigned to the DP83867 PHY with VDDIO = 1.8 V). To configure other PHYs, use the names eth1, eth2, eth3. The block diagram in [this figure](#) shows which PHYs correspond to which names.
  - iv. After changing the desired PHY's IPv4 address, make sure that all other PHY ports are down by running:
    1. `ifconfig [eth0, eth1, eth2, eth3] DOWN`
  - v. Finally, from the Tera Term console, run the following command:
    1. `ping [PC_IPv4_ADDRESS]`
  - vi. You should see an output similar to what is below:

```

PING 169.254.206.64 (169.254.206.64): 56 data bytes
64 bytes from 169.254.206.64: seq=0 ttl=128 time=244.465 ms
64 bytes from 169.254.206.64: seq=1 ttl=128 time=1.206 ms

```

### 2. Using the mactest Utility

- a. After the user enables the mactest utility in the build image at [this](#) step, the user should be able to run mactest commands from the U-Boot command line in the Tera Term console .
- b. The mactest utility allows the user to see what combinations of MAC interface settings (RGMII input and output clock delay settings) enable reliable communication between the MAC and the PHY.
- c. To open the mactest utility, the user must interrupt the Linux boot with a keypress. The user will have about 3 seconds to press any key when an interrupt message appears. Then the user will enter the U-Boot command line.
- d. In the U-Boot command line, run the following command:
  - i. `mactest 0 0 7 2010 0 1`
- a. Note: the first two numbers specify the Ethernet port that mactest will perform tests on. So, to test port eth1, the user would run:
  - i. `mactest 1 1 7 2010 0 1`
- a. After running the test, the user will see a printout showing which RGMII delay settings caused packets to be lost, packets to be transmitted but with a faulty Cyclic Redundancy Check (CRC) value, or packets to be transmitted successfully. The y-axis sweeps through RGMII output clock delay settings and the x-axis sweeps through RGMII input clock delay settings. The user should see a printout similar to the image below.

As seen in the figure below, there are small pockets of useable delay settings depicted by the rectangular areas containing the "." character. These pockets show the user where the delay settings meet the timing requirements

of the PHY. Additionally, for 100 Mbps tests, these pockets are larger in area because the timing requirements are more relaxed.

```

Legend:
  o : OK
  x : CRC error
  . : packet not found
System default setting
  O : OK
  X : CRC error
  * : packet not found

[1G ]=====>

+++++
00000000000000001111111111111122222222222222223333333333333333
0123456789abcdef0123456789abcdef0123456789abcdef0123456789abcdef
|
00: xxxxxx.....xxxx00000000xx..xx.xx0000000000xxxx.....
01: oxxxxxxxxxxxxxxxxxxxxxxxxxxxx00000000xx..xx.x0000000000xxxx.....x
02: xxxxxx.....xxxx00000000xx..xx.xx0000000000xxxxxxxxxxxxxxxxxxx
03: xxxxxx.....xxxx00000000xxxxxxxx.xx0000000000xxxx.....
04: xxxxxx.....xxxx00000000xxxxxxxx.xx0000000000xxxx.....
05: xxxxxx.....xxxox000000xx..xx.xxxoxxxxxoxxxxxxxxxxxxxxxxxxxx
06: xxxxx.....xxxxxxxxxxxxxxxx..xx.xxxxxxxxxxxxxxxxx.....
07: xxxxxxxx.....xxxxxxxxxxxxxxxx..xx.xxxxxxxxxxxxxxxxx.....
  
```

**Figure 2-1. mactest Output for 1 Gbps MAC Interface**



## 3 Hardware

### 3.1 Separate Power Rail

Users have the option to read and write to registers of each PHY on the EVM without having the EVM connected to the AST2600 EVB. To do this, users must populate the headers circled below and apply 12V across the “12V” and “GND” pins. The 12V connection is the top left pin in J701, while GND pins are any pins on the outer side of the header.

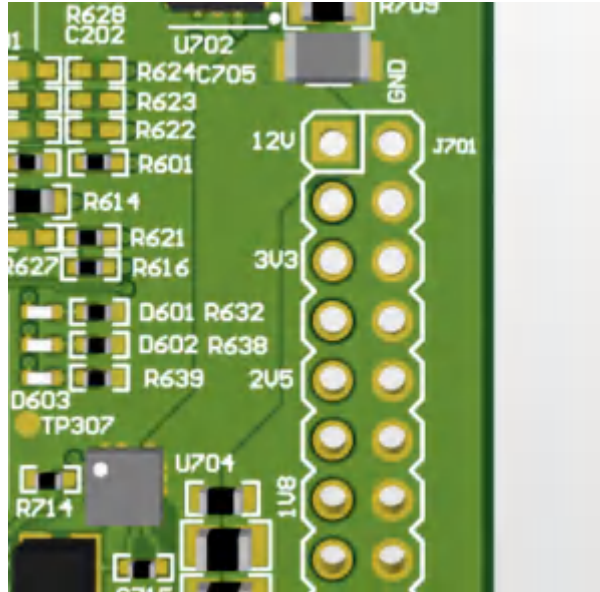
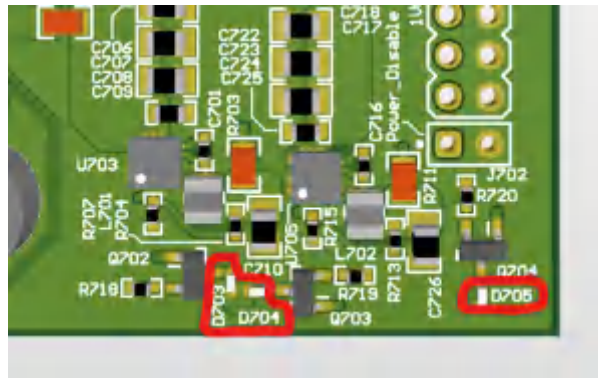


Figure 3-1. Power Rail for Standalone Operation

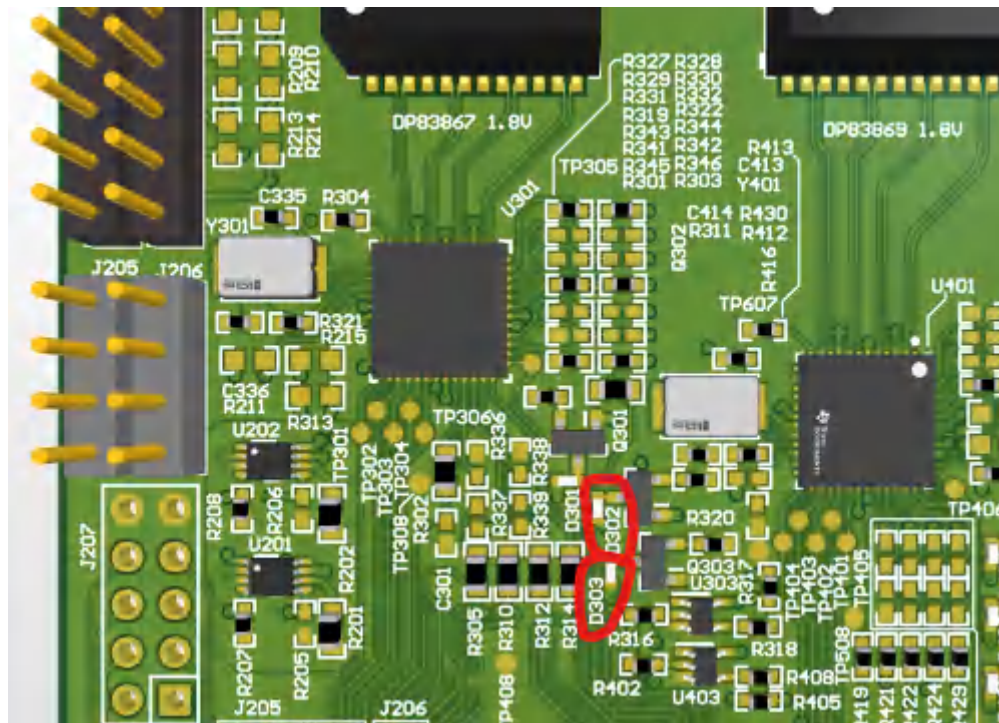
### 3.2 Status LEDs

The ASPEED Ethernet PHY EVM contains many supply voltages levels (1.0V, 1.1V, 1.8V, 2.5V) for each PHY. Make sure that the on-board LDOs are functioning properly and outputting the necessary supply voltages, the user can refer to the circled LEDs below on the bottom right of the EVM. D703 will illuminate for an active 1.1V, D704 for an active 1.0V and D705 for an active 1.8V.



**Figure 3-2. Power Status LEDs**

Each PHY also contains link status and link activity LEDs. The link status LEDs are active when a link is established and the link activity LEDs are active when there is any receive or transmit activity. The link status and link activity LEDs for the DP83867 with VDDIO = 1.8V is shown below (the silkscreen designators are D302 and D303).



**Figure 3-3. Link Status LEDs for DP83867 with VDDIO = 1.8V**



### 3.3 MDC/MDIO Headers

The EVM contains headers for access to the MDC and MDIO lines of each PHY independent of the ASPEED EVB. This is useful for debugging purposes when the user would like to read and write to a PHY's registers without connecting the EVM to the ASPEED AST2600 EVB.

To read/write registers through these headers, the user **must disconnect** the EVM from the ASPEED EVB and separately power the EVM using the J701 jumper header as described [here](#). Once the board is powered on this rail, the user can connect jumper wires from a microcontroller like Texas Instruments's LaunchPad [here](#). Connect the LaunchPad's MDC/MDIO jumpers to the EVM's MDC/MDIO jumpers of the desired PHY. Please reference the silkscreen below for jumper selection.

Once the LaunchPad is connected, users can use the USB2MDIO tool to read and write to each register for each PHY. More information about the tool is provided [here](#).

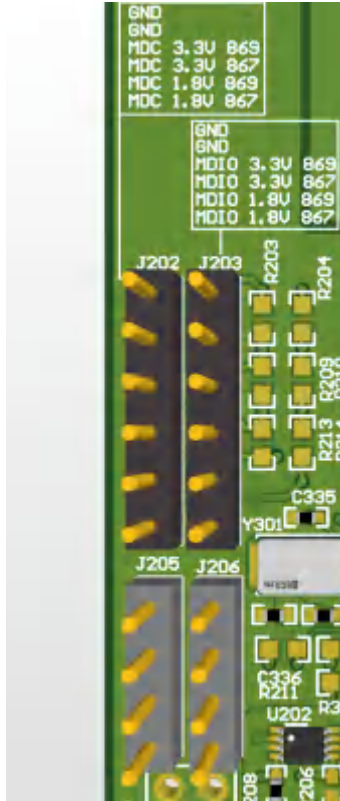


Figure 3-4. MDC/MDIO Access Headers

### 3.4 MDC/MDIO Level Shifters

One key feature of this EVM is that level shifters are used to allow the PHYs to communicate with the ASPEED AST2600 processor. The AST2600 contains four RGMII interfaces, however, two of them are forced to use VDDIO = 1.8V. However, the MDC/MDIO lines from the AST2600 all have VDDIO = 3.3V. So, to have a consistent VDDIO level, level shifters are used to convert the MDC/MDIO voltage level from 3.3V to 1.8V.

One important design consideration is that the level shifters used contain built-in pullup resistors, so users must include these resistor values in their calculations when deciding what pull-up resistor to use for the MDIO lines. The schematic below shows which level shifters were used.

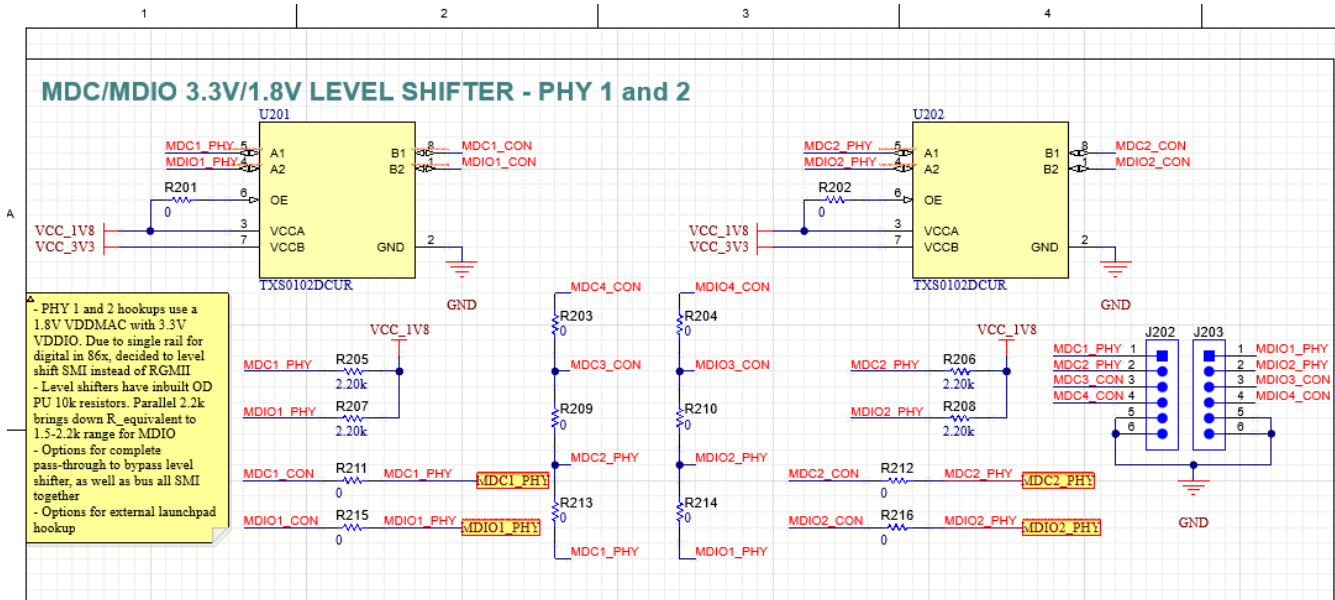


Figure 3-5. Schematic : MDC/MDIO Level Shifters

### 3.5 Manual Reset

The ASPEED Ethernet EVM also contains a manual reset button which causes a hard-reset of all PHYs when pressed. This is achieved by driving the active-low pins of each PHY to LOW. The reset circuitry also has an automatic reset that is triggered when VCC (OVDD\_3V3) falls below 2.93V.

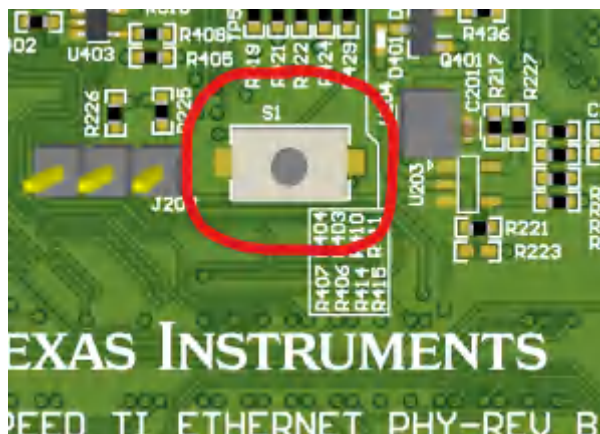


Figure 3-6. Manual Reset Push Button

## 4 Software

### 4.1 GUI Installation

Users can read and write to registers on the ASPEED Ethernet PHY EVM without using the ASPEED AST2600 EVB. To do this, users must disconnect the EVM from the ASPEED EVB, provide 12V power to the EVM power rail, and connect an MSP430 launchpad to the MDIO/MDC headers on the EVM. USB2MDIO software can be used for accessing the registers of the PHY. The software is available to download along with the user's guide in the link: [USB2MDIO](#).

## 5 Hardware Design Files

### 5.1 Schematics

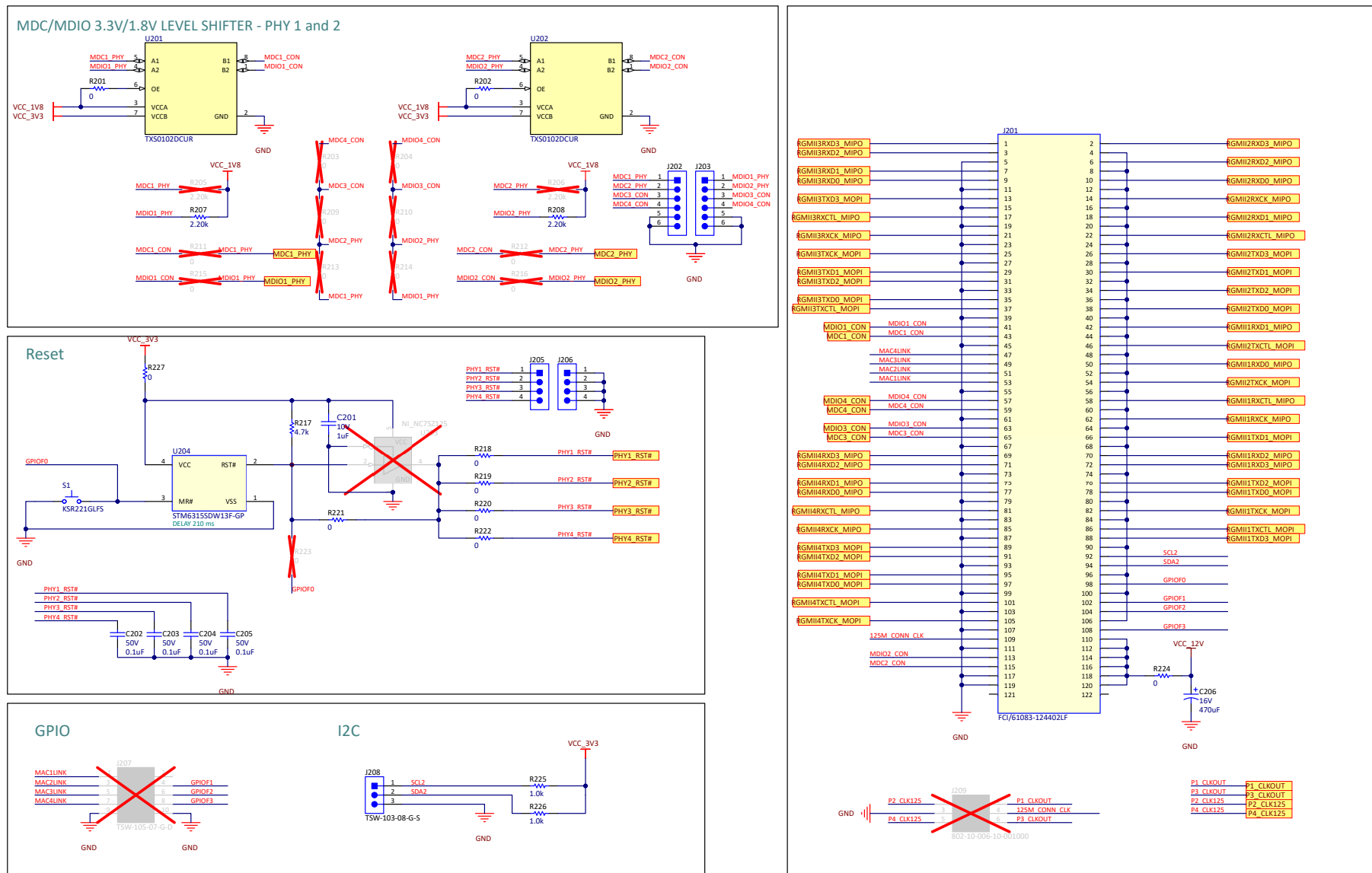


Figure 5-1. Schematic : Connectors

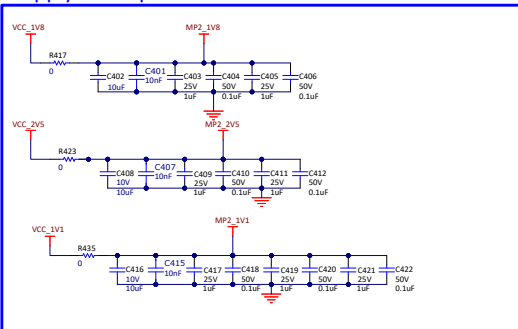




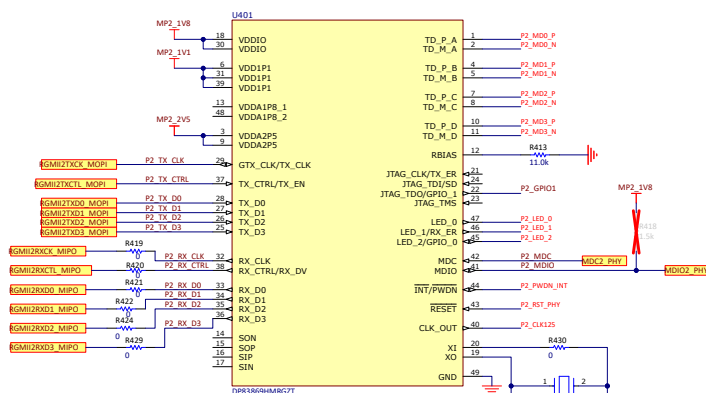
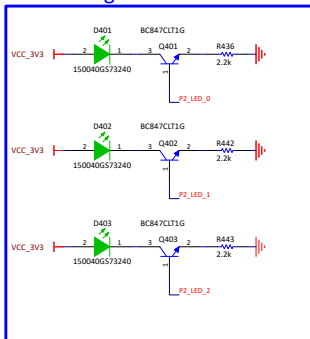
Hardware Design Files



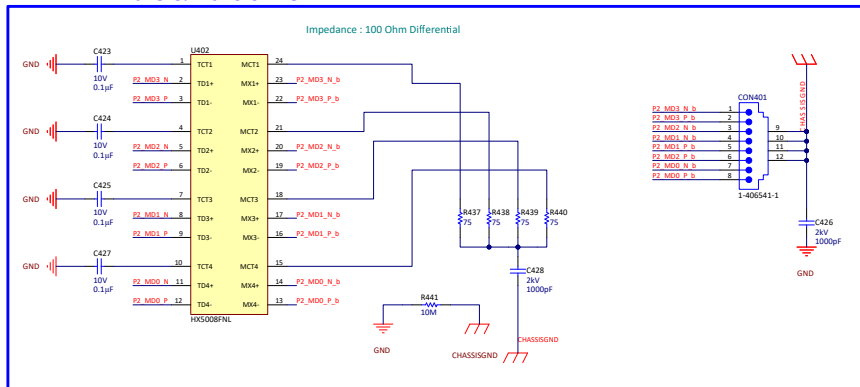
Supply Decouple



LEDs Configuration



RJ45 & Transformer



Strapping

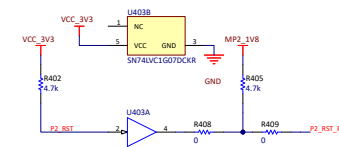
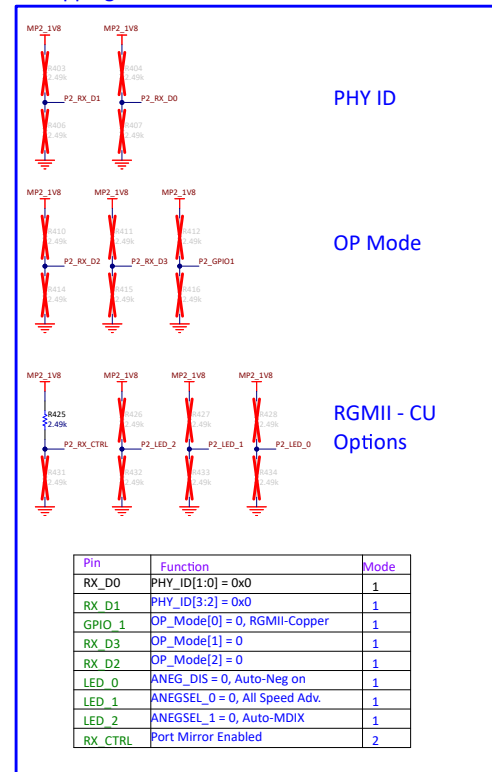
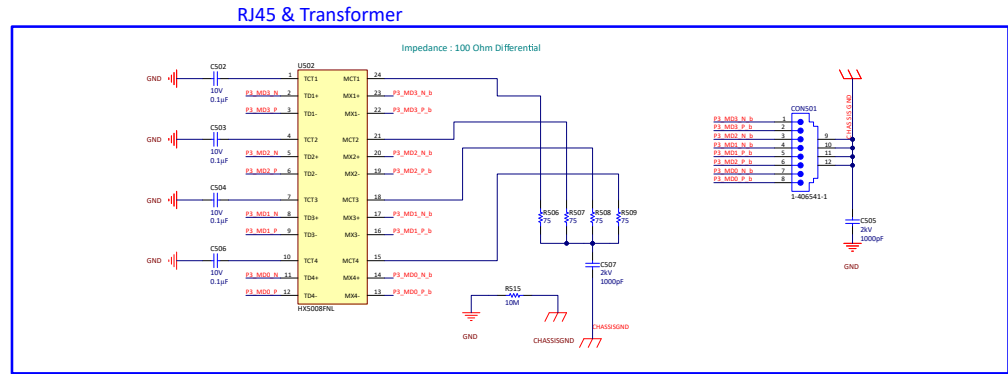
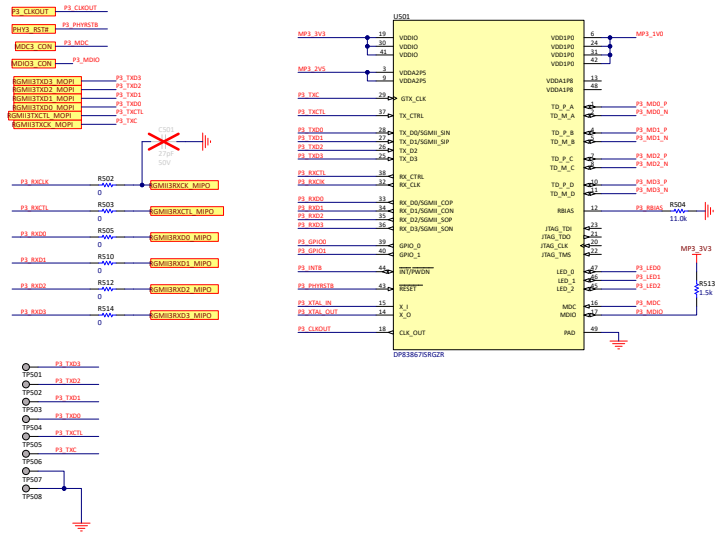


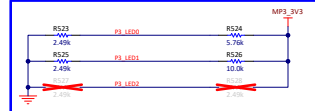
Figure 5-3. Schematic : DP83869 with VDDIO = 1.8V



**PHY PWDN/INTB**



**LED Straps**



Pin	Function	Mode
LED0	Mirror Mode On, SGMII Off	3
LED1	Auto-Neg All Speed, TX[2] = 1	2
LED2	TX[1:0] = 00	1
RX_D0	PHY_ID[1:0] = 0x0	1
RX_D2	PHY_ID[3:2] = 0x0	1
RX_CTRL	Auto-Neg Enabled	3
GPIO0	RX[0] = 0	1
GPIO1	RX[2:1] = 0x2	3

**PHY Address Config.**



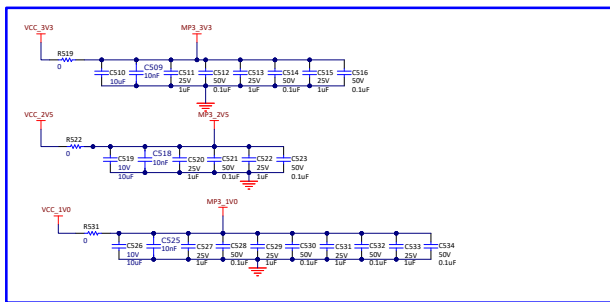
**GPIO Straps**



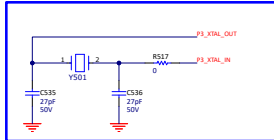
**ANEG Disable**



**Supply Decouple**



**Crystal**



**LEDs Configuration**

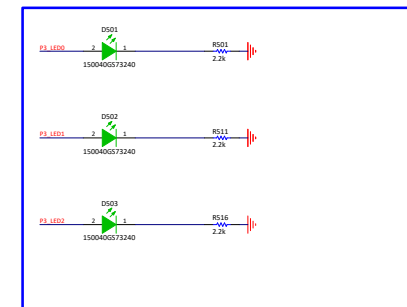
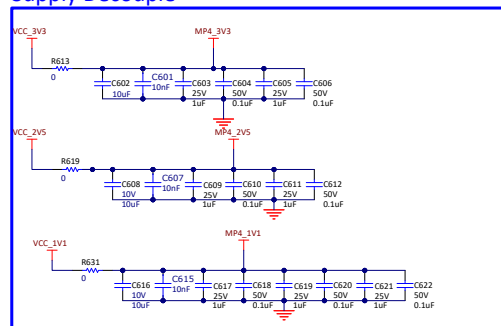
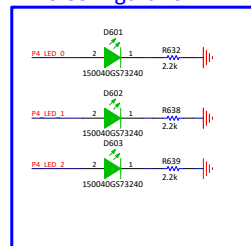


Figure 5-4. Schematic : DP83867 with VDDIO = 3.3V

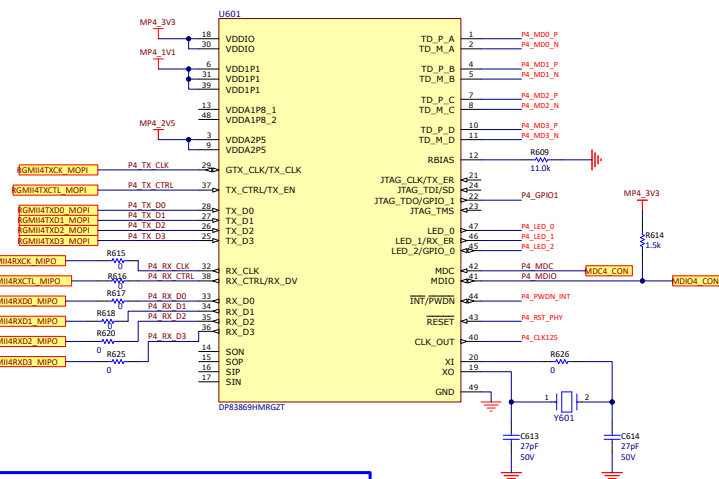
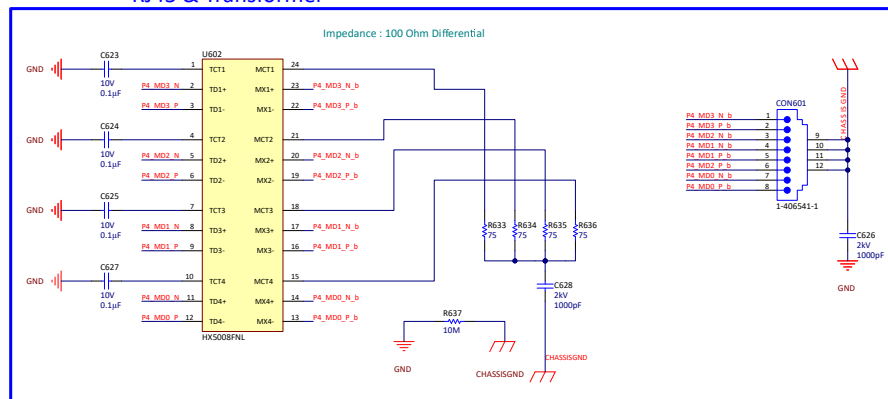
Supply Decouple



LEDs Configuration



RJ45 & Transformer



Strapping

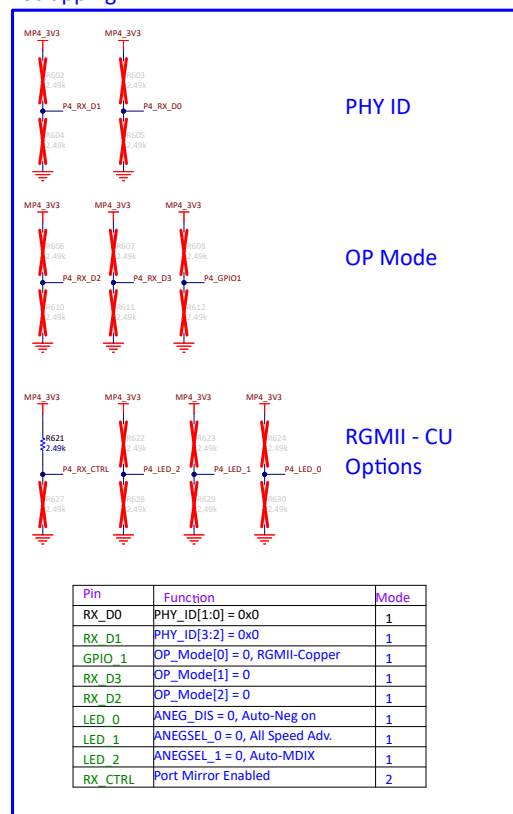


Figure 5-5. Schematic : DP83869 with VDDIO = 3.3V

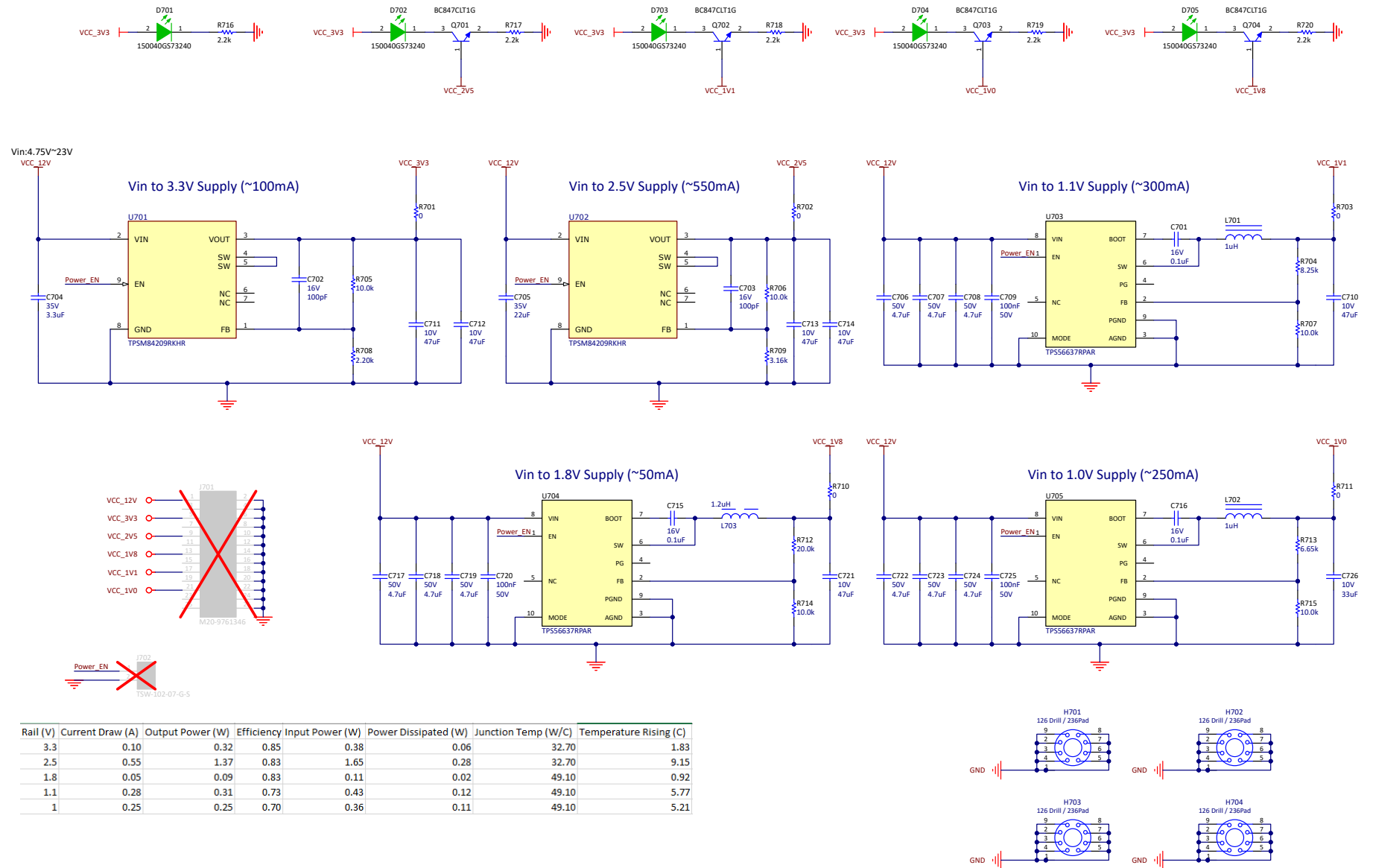


Figure 5-6. Schematic : DC Power

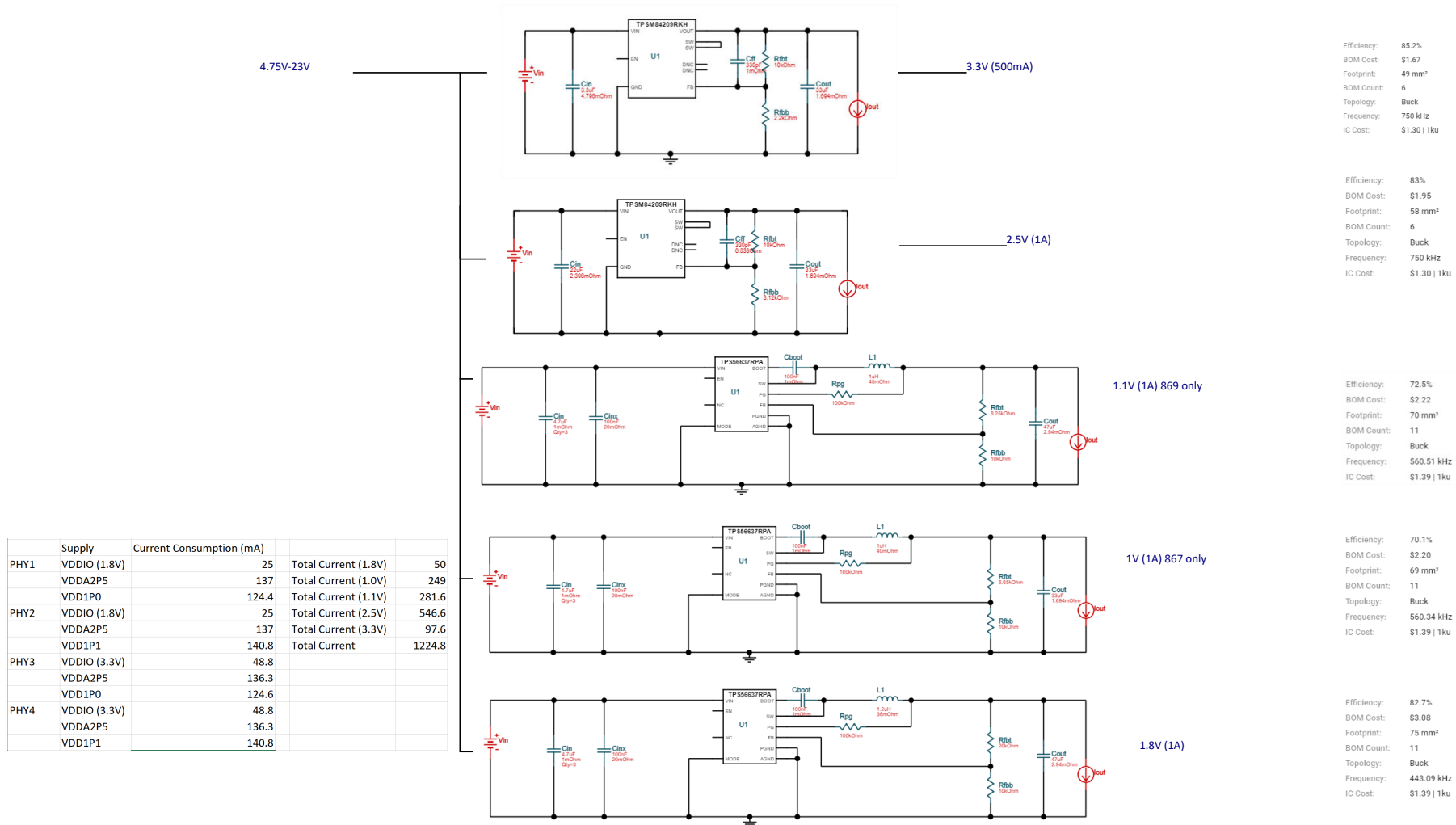


Figure 5-7. Schematic : Power Calculations



## **6 Additional Information**

### **6.1 Trademarks**

All trademarks are the property of their respective owners.

## STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
  - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
  - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
  - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
  - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
  - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

### **WARNING**

**Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.**

**User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.**

**NOTE:**

**EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.**

### 3 Regulatory Notices:

#### 3.1 United States

##### 3.1.1 Notice applicable to EVMs not FCC-Approved:

**FCC NOTICE:** This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

##### 3.1.2 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**

*NOTE: 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**

*NOTE: 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.

#### 3.2 Canada

##### 3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

#### **Concerning EVMs Including Radio Transmitters:**

This device complies with Industry Canada license-exempt RSSs. 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.

#### **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.

#### **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.

### 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.

#### 3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see [http://www.tij.co.jp/lstds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page) 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs 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 EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないものご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。日本テキサス・イ

ンスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see [http://www.tij.co.jp/lstds/ti\\_ja/general/eStore/notice\\_02.page](http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page)

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 <https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

#### 3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

- 
- 4 *EVM Use Restrictions and Warnings:*
    - 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
    - 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
    - 4.3 *Safety-Related Warnings and Restrictions:*
      - 4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should 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 also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.
      - 4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure 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. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.
    - 4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.
  5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
  6. *Disclaimers:*
    - 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
    - 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.
  7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL 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 HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.
-



8. *Limitations on Damages and Liability:*

8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2023, Texas Instruments Incorporated

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2024, Texas Instruments Incorporated