参考文献

*EVM User's Guide: DP83TC110X-EVM-MC*

# *DP83TC110X-Q1 介质转换器评估模块*

## 说明

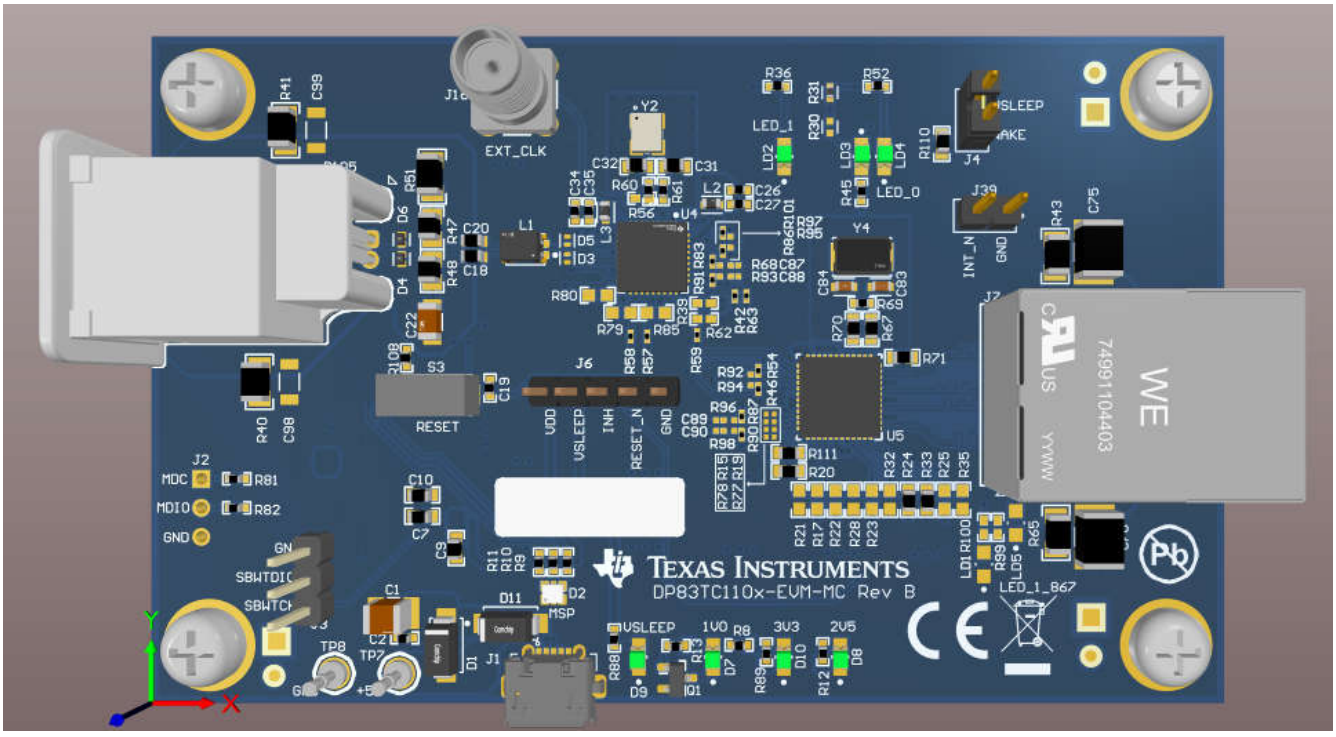
DP83TC110X-EVM-MC 支持 100Mbps 速度，并且符合 IEEE 802.3bw 标准。DP83867 支持标准以太网 (100BASE-TX)，允许在 100Base-T1 单线对以太网和 100Base-TX 标准以太网之间进行介质转换。板载 MSP430F5529 可通过 USB2MDIO 工具轻松访问寄存器。

## 特性

- 介质转换器：100BASE-T1 转 100BASE-TX
- RGMII 或 SGMII 背对背配置
- 用于支持即插即用 USB2MDIO 的板载 MSP430F5529
- TC10 睡眠和唤醒功能
- 用于链路、活动和电源轨的状态 LED

## 应用

- ADAS
  - 雷达
- 车身电子装置和照明
  - 车身控制模块
  - 区域控制模块
- 远程信息处理




**DP83TC110X-EVM-MC**



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# 1 评估模块概述

## 1.1 简介

DP83TC110X-EVM-MC 可帮助用户评估德州仪器 (TI) DP83TC110X-Q1 PHY 系列的特性。本 EVM 用户指南详细介绍了如何正确操作和配置 DP83TC110X 介质转换器评估模块 (EVM)，并包含硬件和软件设置说明。

此 EVM 具有多个可订购型号，支持对多个类似的 PHY 器件进行评估。

| EVM 可订购器件型号 | 100Base-T1 PHY |
|---|---|
| DP83TC1103A-EVM-MC | DP83TC1103A-Q1 |
| DP83TC1103B-EVM-MC | DP83TC1103B-Q1 |
| DP83TC1104A-EVM-MC | DP83TC1104A-Q1 |
| DP83TC1104B-EVM-MC | DP83TC1104B-Q1 |

## 1.2 套件内容

DP83TC110X-EVM-MC 套件包含以下项目：

- DP83TC110X-EVM-MC
- 微型 USB 电缆

未提供：

- 具有 MATEnet 适配器的单线对以太网电缆
- 标准以太网电缆

## 1.3 规格

图 1-1 显示了方框图。

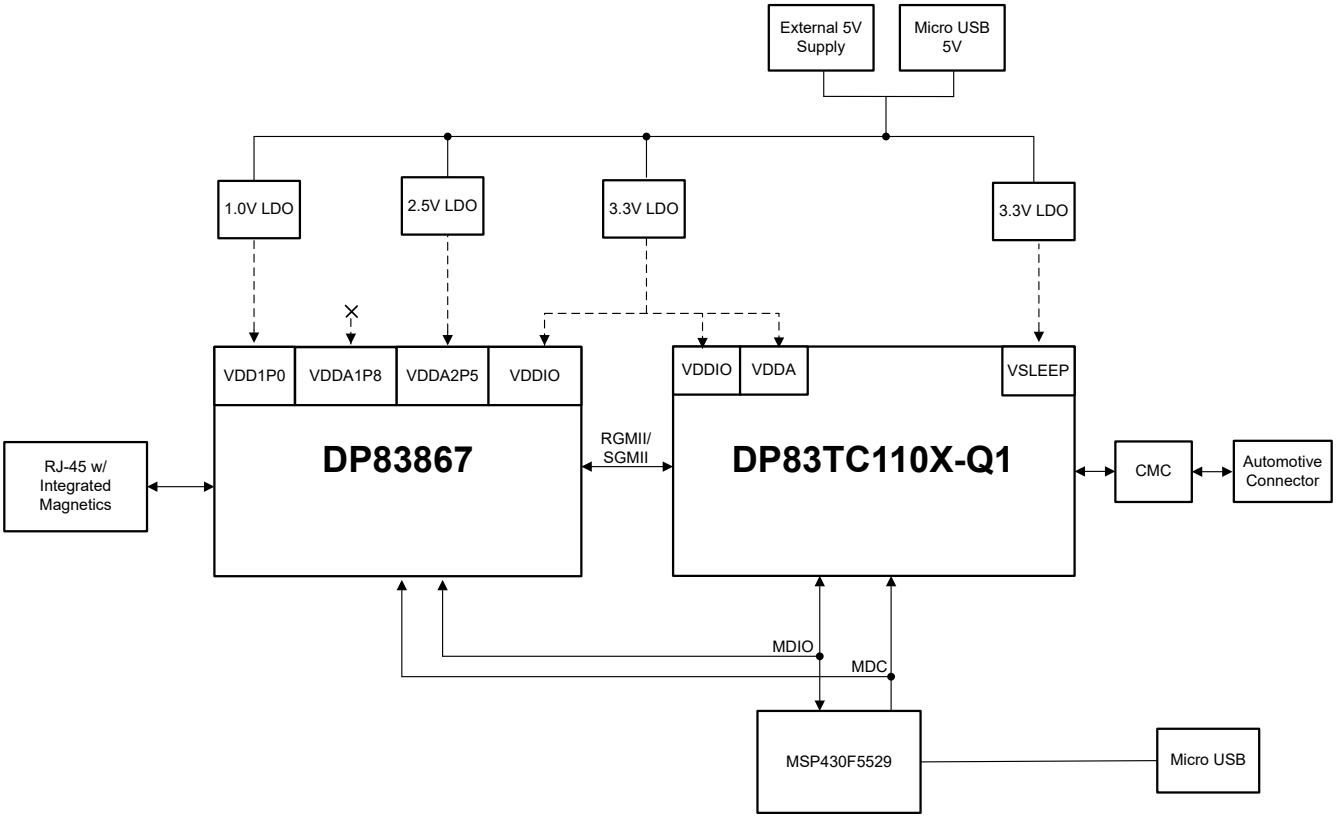



**图 1-1. DP83TC110X-EVM-MC 方框图**



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## 1.4 器件信息

DP83TC110X-EVM-MC 中所用的关键器件包括：

- DP83TC110X-Q1
  - 用于 100Mbps 单线对以太网信号传输
- DP83867
  - 用于标准以太网信号传输
- MSP430F5529
  - 用于通过 USB2MDIO 访问 DP83TC110X-Q1 和 DP83867 的寄存器


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# 2 硬件

## 2.1 操作 - 快速入门

1. 用 Micro-USB 电缆将 J1 连接到任何 Windows 笔记本电脑或 PC。
2. 打开笔记本电脑或 PC 上的 USB-2-MDIO。
3. 读取两个板载 PHY 上的寄存器 0x0003，并查看这些值是否匹配表 2-1。

**表 2-1. 默认寄存器 0x3 值**

| 器件 | 寄存器 0x3 值 |
|---|---|
| DP83TC1103A-Q1 (PHY_ID = 27) | 0xA2F0 |
| DP83TC1103B-Q1 (PHY_ID = 27) | 0xA2F0 |
| DP83TC1104A-Q1 (PHY_ID = 0) | 0xA2B2 |
| DP83TC1104B-Q1 (PHY_ID = 0) | 0xA2B2 |
| DP83867 (PHY_ID = 1) | 0xA231 |

4. 请参阅 Board Start-up Register Configuration 以了解电路板启动寄存器配置。
5. 电路板现在已可连接到链路伙伴。使用带有 MATEnet 连接器的一对以太网电缆，连接另一个 DP83TC110X-EVM-MC。
   a. 确认已正确配置引导器/跟随器和自主/受管选择（通过寄存器写入）。
   b. 确保已安装 WAKE 跳线，否则器件会处于睡眠模式。
   c. 验证电源和链路 LED 是否亮起（请参阅 LED Indication）。
6. 对于介质转换，请将标准以太网电缆连接到 RJ45 端口 (J7)。

## 2.2 电路板连接

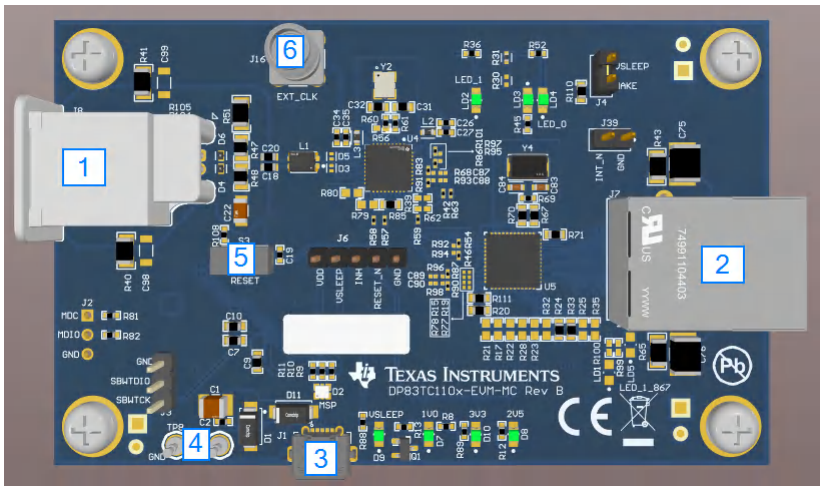



**图 2-1. 电路板连接**



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| 编号 | 说明 |
|---|---|
| 1 | MATEnet 单线对以太网连接器 |
| 2 | RJ45 标准以太网连接器 |
| 3 | 用于供电和数据传输的 Micro-USB |
| 4 | 5V 外部电源选项 |
| 5 | 复位按钮 |
| 6 | DP83TC110X 的外部时钟选件 |

## 2.3 电源要求

DP83TC110X-EVM-MC 可通过两种方式上电：

- 将 micro-USB 电缆连接至 J1
- 或者，将 5V 电源连接到 TP7 (+) 和 TP8 (-)

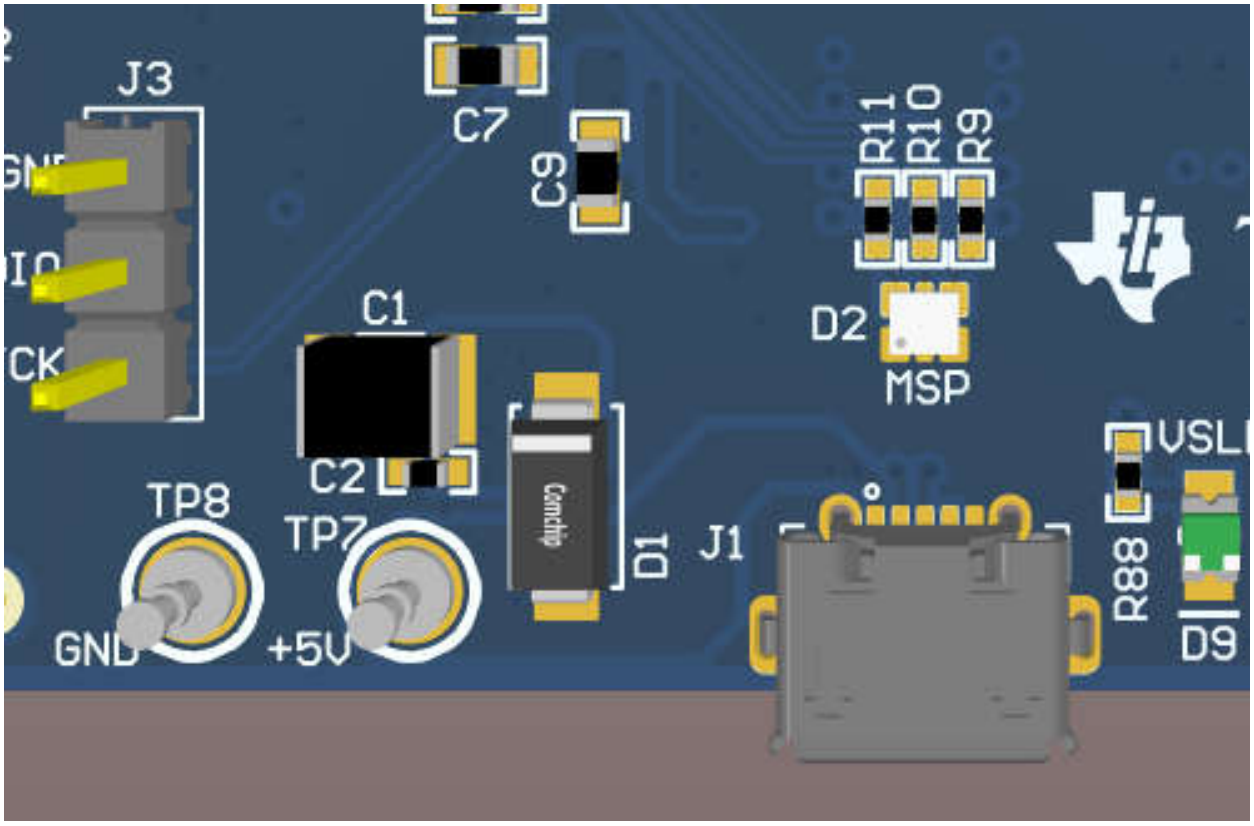



**图 2-2. 电源连接**

## 2.4 MSP 连接

- 默认情况下，板载 MSP430™ 连接到两个 PHY 以进行 MDC/MDIO 通信。
- 要使用外部 MDC/MDIO 连接，请移除 R81 和 R82，然后将 MDC、MDIO 和 GND 连接到 J2。
  - 请注意，默认情况下不组装 J2。在此处安装一个 3 引脚接头，以便于进行外部连接，或将外部连接直接焊接到 J2 焊盘。


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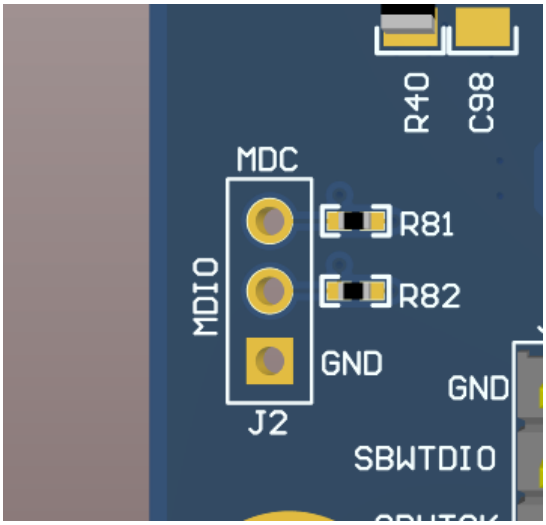



**图 2-3. MDC/MDIO 连接**

## 2.5 MAC 接口选择

DP83TC110X-EVM-MC “A” 型号配置为 RGMII MAC 接口。 “B” 型号配置为 SGMII MAC 接口。

可使用电阻器选项将 “A” 型号配置为 SGMII 模式：

1. 拆卸 R121、R122、R123、R124、R54、R57、R58、R59。
2. 在 R73、R74、R75、R76、R38、R39、R55、R62 上安装 0Ω 电阻器 (0402)。
3. 拆卸 R84、R85。
4. 在 R25 上安装 10kΩ 电阻器 (0603) 并在 R35 上安装 2.49kΩ 电阻器 (0603)。

可以执行上述步骤的反向操作，以将 “B” 型号配置为 RGMII 模式。

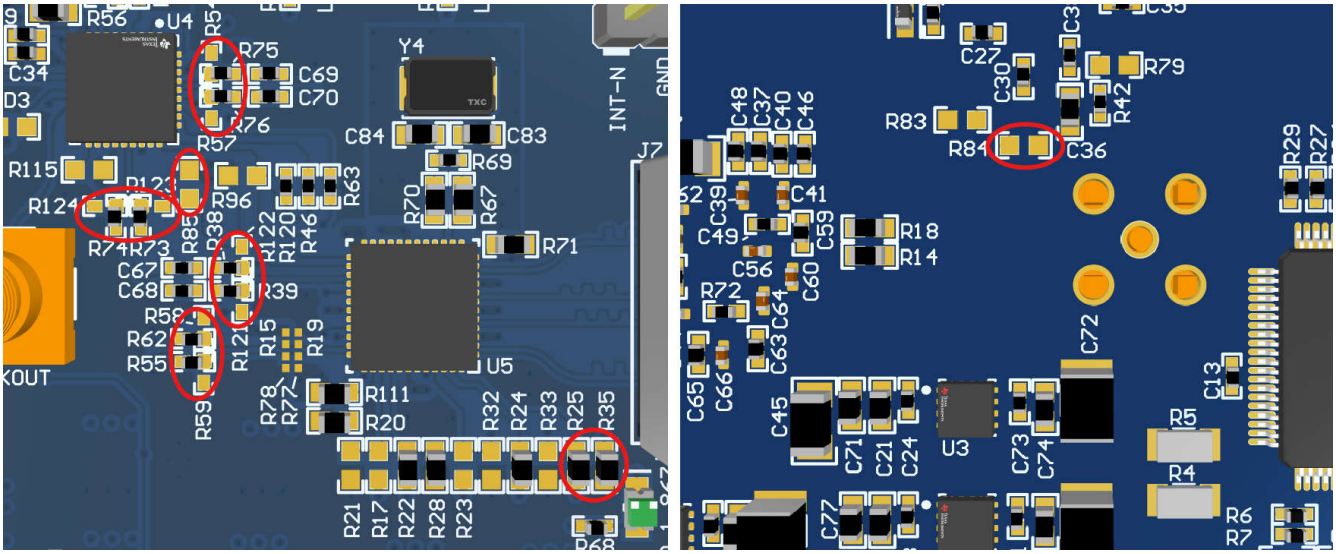



**图 2-4. SGMII 电阻器选项**

## 2.6 LED 指示

- 在 DP83TC110X-Q1 上成功建立链路时，LED_0（LD3 或 LD4）和 LED_1 (LD2) 会亮起。
- LED_1（LD1 或 LD2）闪烁，表示 TX/RX 活动。
- 在 DP83867 上成功建立链路后，RJ45 连接器上的 LED 会亮起。



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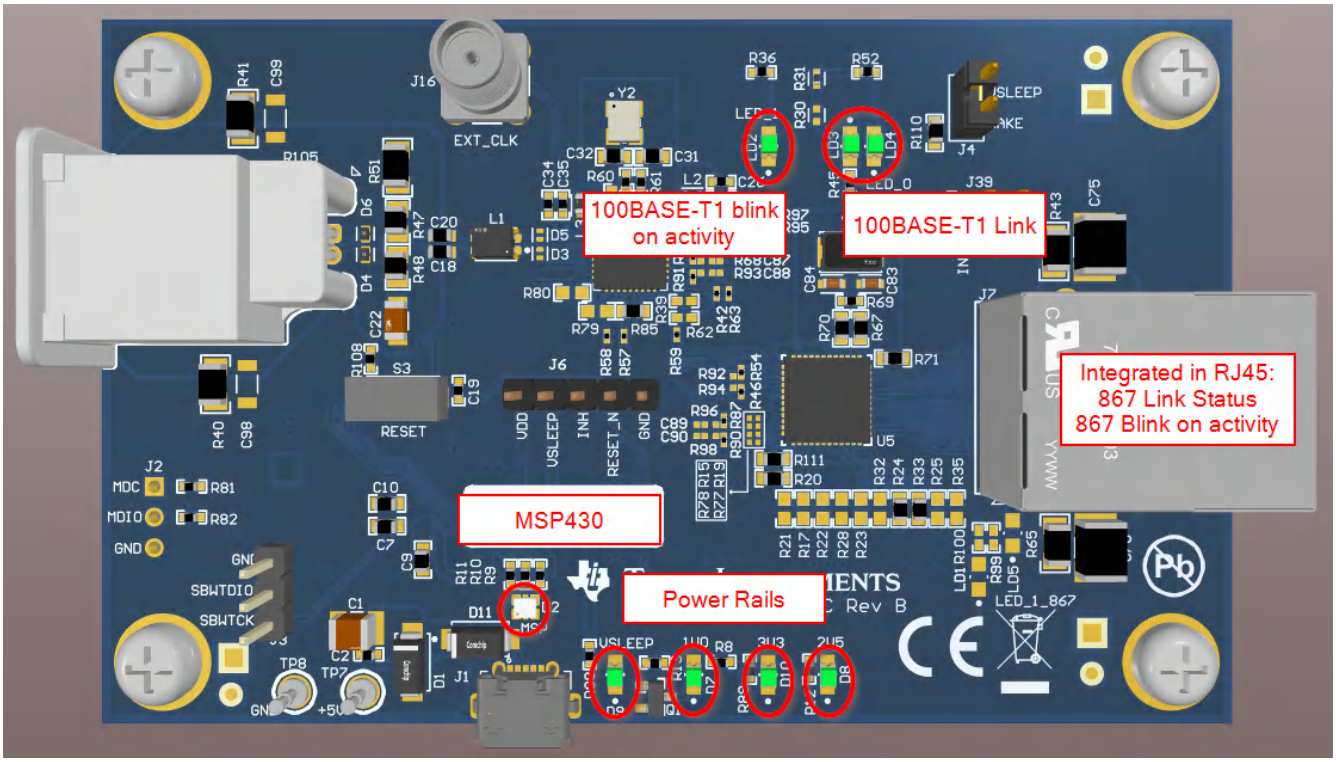



**图 2-5. LED 指示**

## 2.7 参考时钟

DP83TC110X-EVM-MC 支持将晶体振荡器或外部时钟源用作基准时钟的选项。默认情况下已组装晶体。

要启用外部时钟选项，请执行以下操作：

- 拆下 R60 和 R61。
- 使用 0Ω 电阻器 (0402) 组装 R56。
- 将外部时钟源（25MHz 方波、3.3V 振幅）连接到 J16 SMA 连接器。



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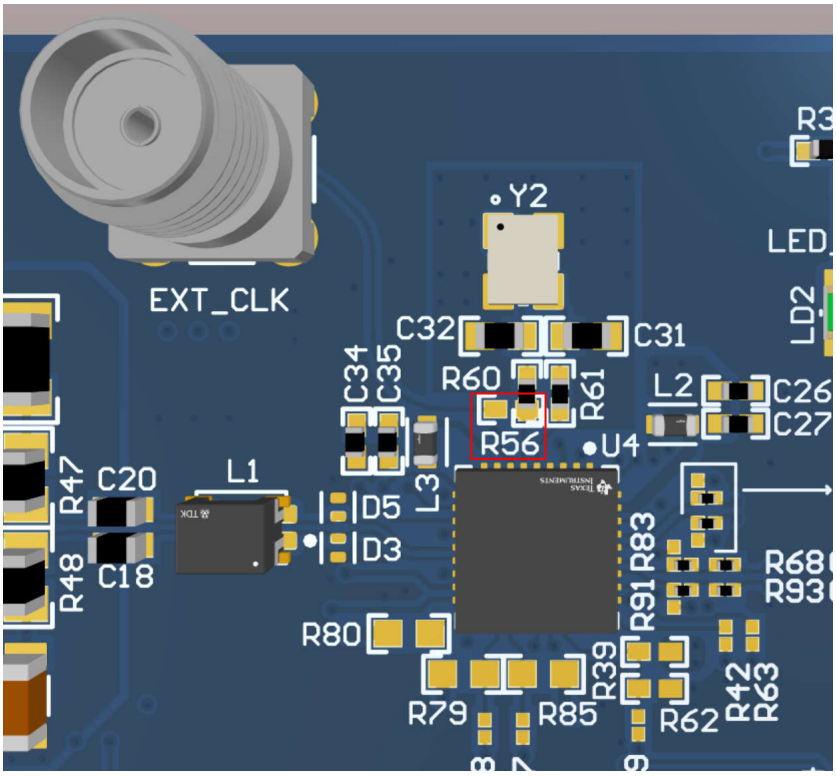



**图 2-6. 外部基准时钟选项**

## 2.8 MDI 连接器

DP83TC110X-EVM-MC 支持多种适合汽车以太网的连接器选项。默认情况下会组装 MATEnet。可通过以下步骤安装 H-MTD 连接器。

要组装 H-MTD 连接器：

1. 拆下 MATEnet 连接器 (J8)。
2. 在 R104、R105 上组装 0Ω 电阻器 (0402)。
3. 安装 H-MTD 连接器。

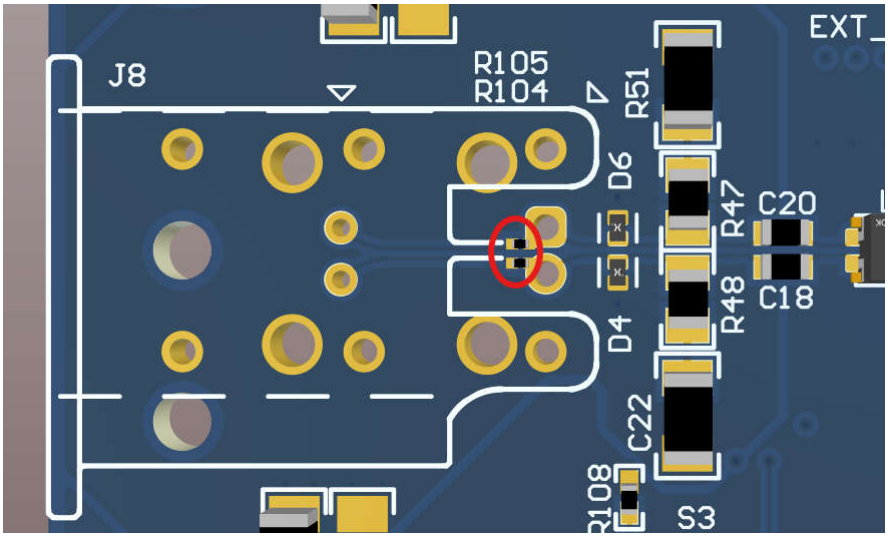



**图 2-7. H-MTD 连接器安装**



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# 3 软件

## 3.1 GUI 安装

板载 MSP430 经过预先编程并可立即供使用。在 Windows® 11 PC 上首次使用此 EVM 时，需要安装 MSP430 驱动程序和 USB-2-MDIO 软件实用程序。USB-2-MDIO 软件可用于访问 PHY 的寄存器。该软件及 EVM 用户指南可以在以下链接中下载：USB2MDIO。

## 3.2 电路板启动寄存器配置

本节中的寄存器配置以 USB2MDIO 脚本格式提供：

```
begin
addr data
end
```

其中，“addr”是 MMD 0x1F 写入地址，“data”是写入数据。

要运行脚本，请将代码块另存为 .txt 文件。通过菜单依次运行 USB2MDIO GUI 中的文件：“File” -> “Open” -> “Script”。

### *3.2.1 一般配置*

DP83867 链路速度配置：

请 DP83867 支持 10/100/1000Mbps 链路速度，但只有 100Mbps 与此 EVM 兼容。连接 100Mbps 链路伙伴，或在连接标准以太网电缆之前，通过写入 DP83867 寄存器 0x9 = 0x0000 来强制 DP83867 建立 100Mbps 链路。

引导器/跟随器模式：

```
begin
//leader mode (only run one)
000D 0001
000E 0834
000D 4001
000E 4000
//follower mode (only run one)
000D 0001
000E 0834
000D 4001
000E 0000
end
```

自主/受管模式：

```
begin
//Autonomous Mode (only run one)
018b 1c4b
//Managed Mode (only run one)
018b 1c0b
end
```

### *3.2.2 DP83TC1103A-Q1 特定的寄存器配置*

DP83TC1103A-Q1 默认以跟随器模式和受管模式上电。请使用 General Configuration 将 DP83TC1103A-Q1 配置为引导器模式（如果需要）和自主模式。

此外，修订版 A 板无法在 DP83867 上实现足够的 RGMII RX 和 TX 延迟。对于修订版 A 电路板，将 USB2MDIO 中的 PHY ID 更改为 PHY ID 1（DP83867 配置的 PHY ID），然后写入以下脚本以增加 DP83867 上的延迟。

```
begin
//ensure PHY ID is set to 1 to write to DP83867
0086 00ee
end
```


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### 3.2.3 DP83TC1103B-Q1 特定的寄存器配置

DP83TC1103B-Q1 默认以跟随器模式和受控模式上电。请使用 General Configuration 将 DP83TC1103B-Q1 配置为引导模式（如果需要）和自主模式。

要将 DP83TC1103B-Q1 设置为 SGMII 模式，需要进行寄存器写入。必须在引导器/跟随器和自主配置之前写入以下 SGMII 寄存器。SGMII 链路建立需要使用自主模式：

```
begin
//SGMII mode register writes
0608 027B
0600 0020
0648 0100
001f 4000
end
```

### 3.2.4 DP83TC1104A-Q1 和 DP83TC1104B-Q1 特定的寄存器配置

默认情况下，DP83TC1104A-Q1 和 DP83TC1104B-Q1 上电时，MACsec 被启用。对于无差错介质转换器应用，必须关闭 MACsec：

```
begin
0f28 0001
end
```



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# 4 硬件设计文件

## 4.1 原理图

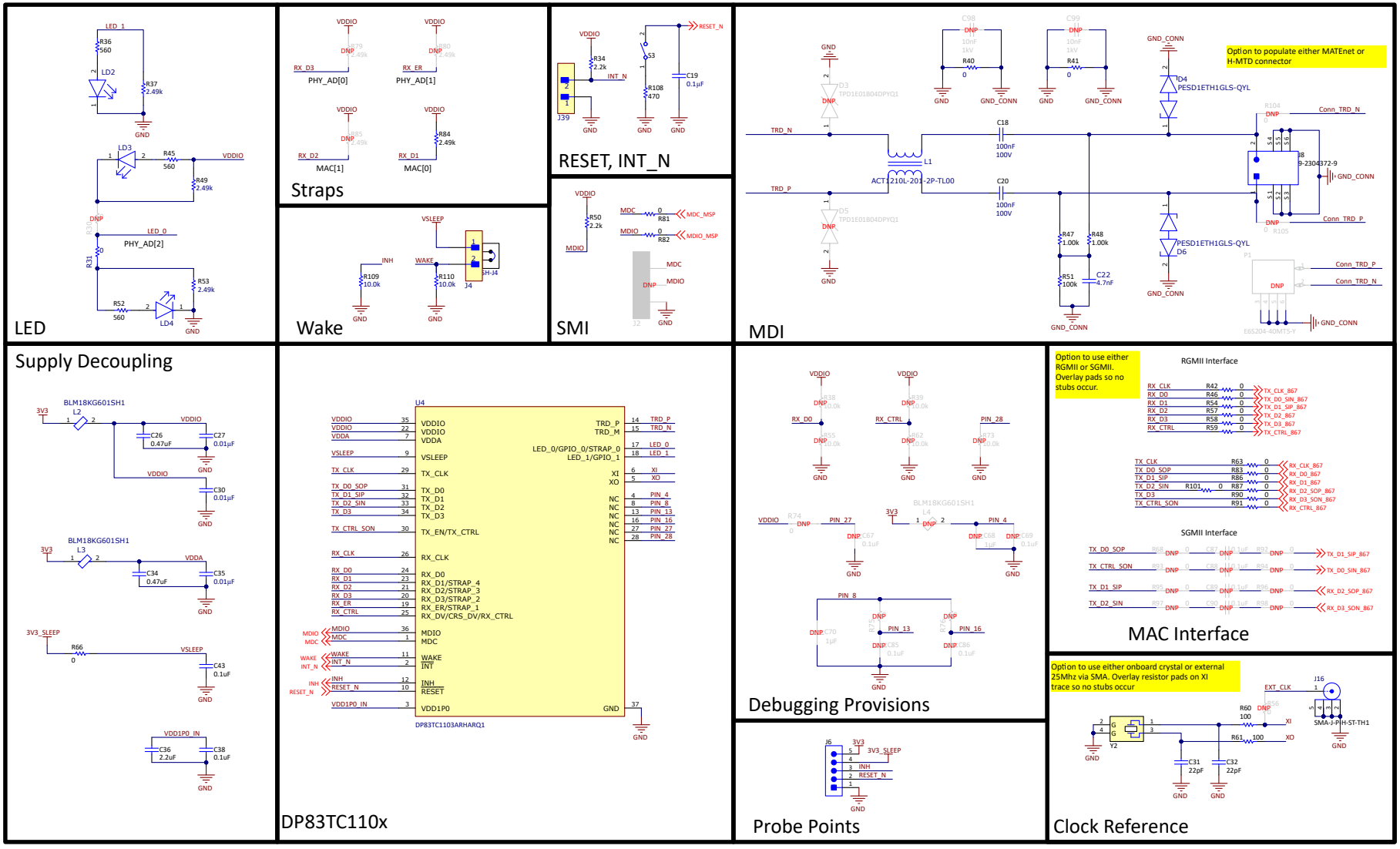



**图 4-1. 原理图：DP83TC1103A-Q1**



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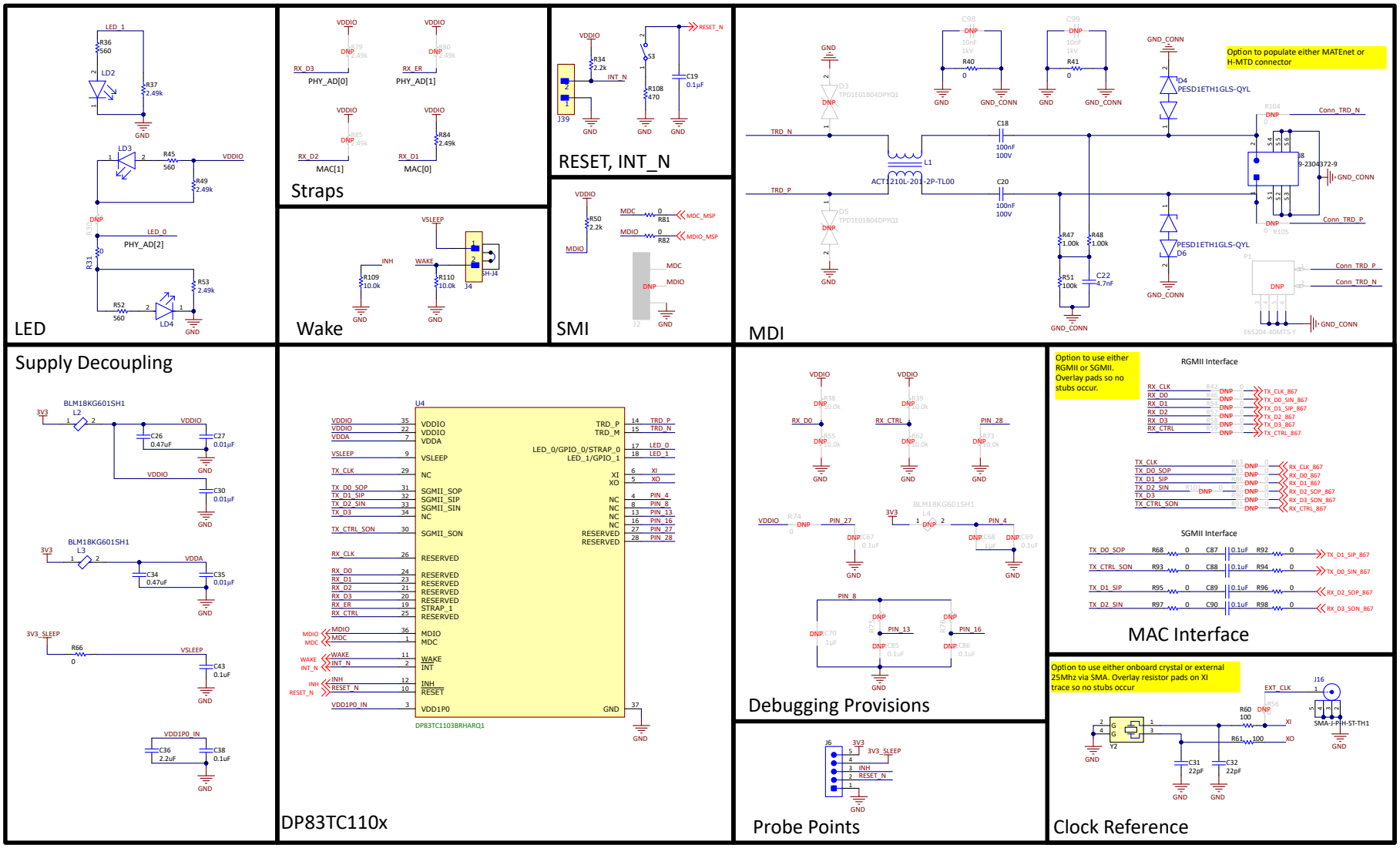



**图 4-2. 原理图：DP83TC1103B-Q1**



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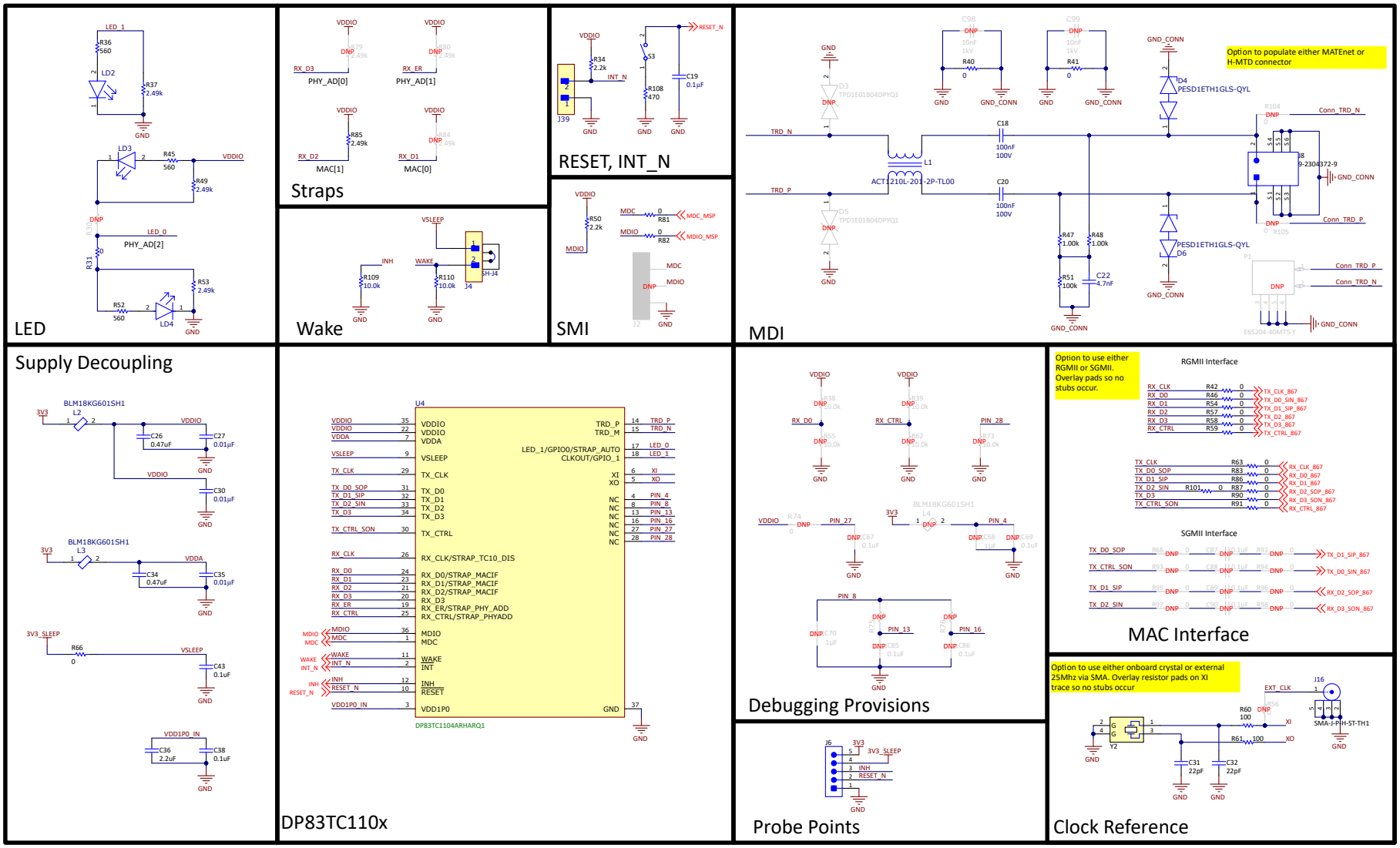



**图 4-3. 原理图：DP83TC1104A-Q1**



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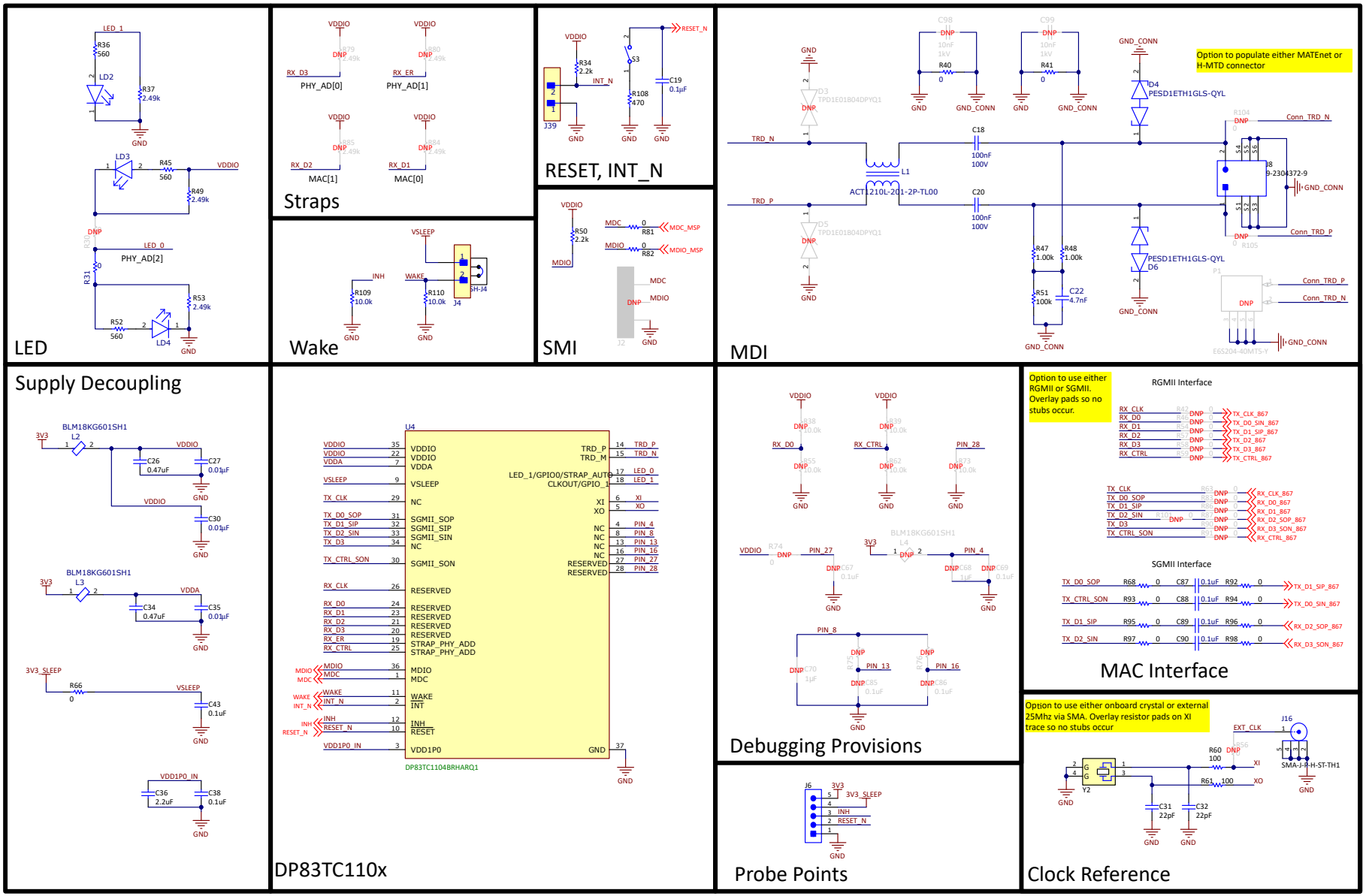
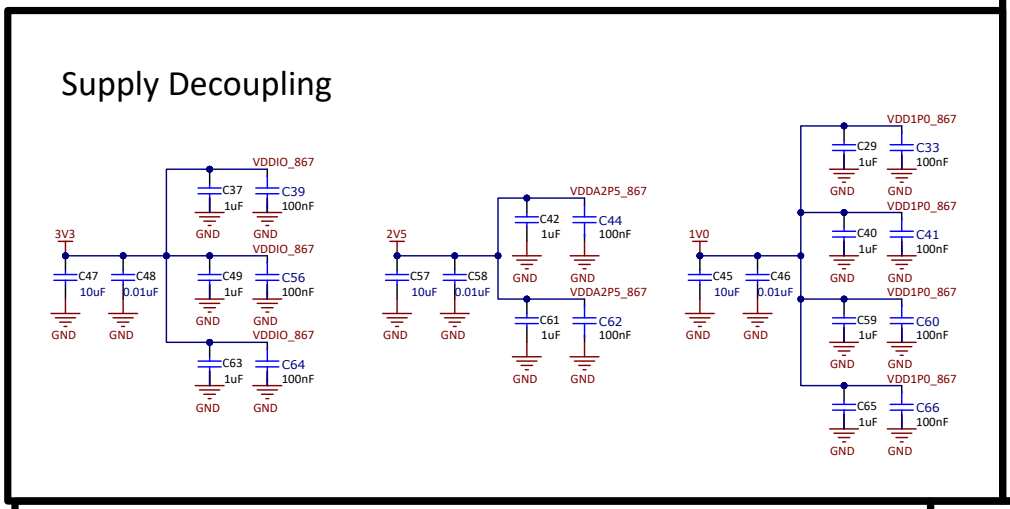
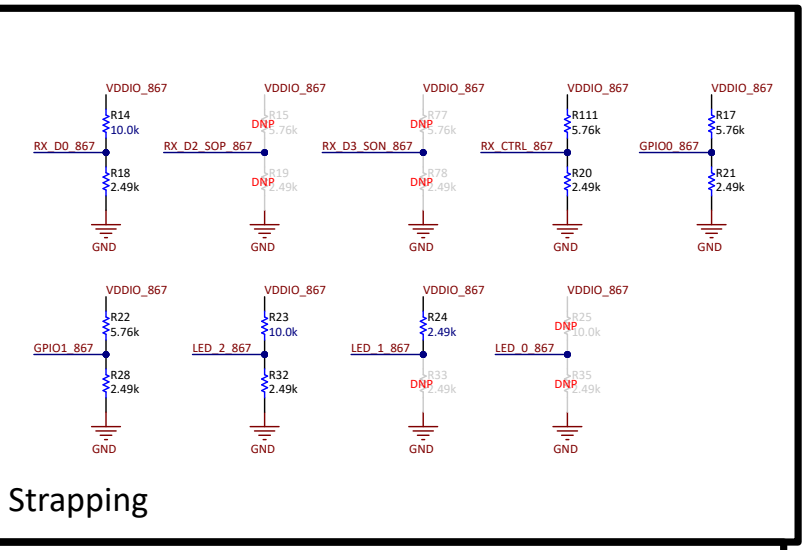


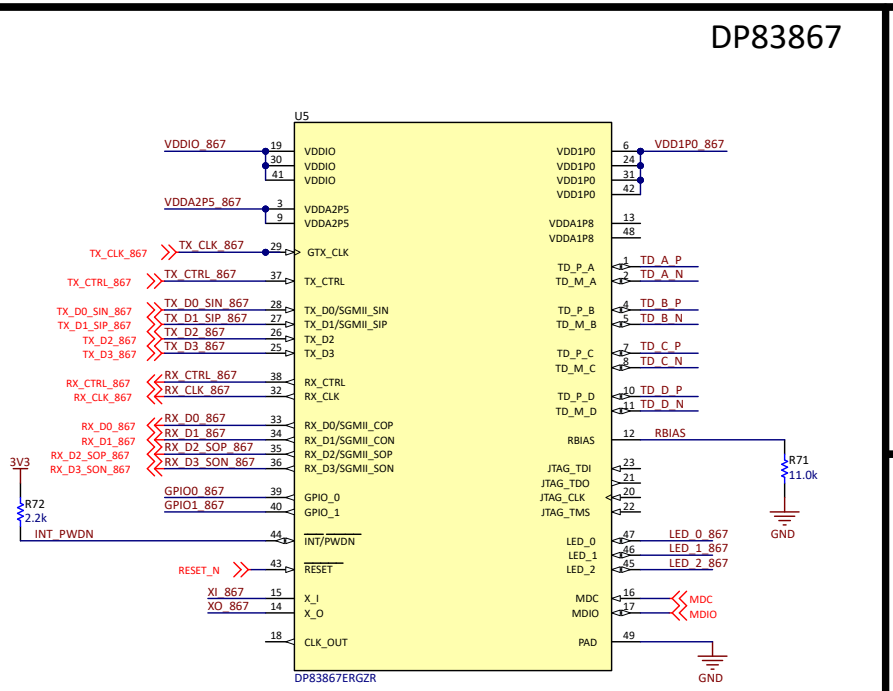

**图 4-4. 原理图：DP83TC1104B-Q1**



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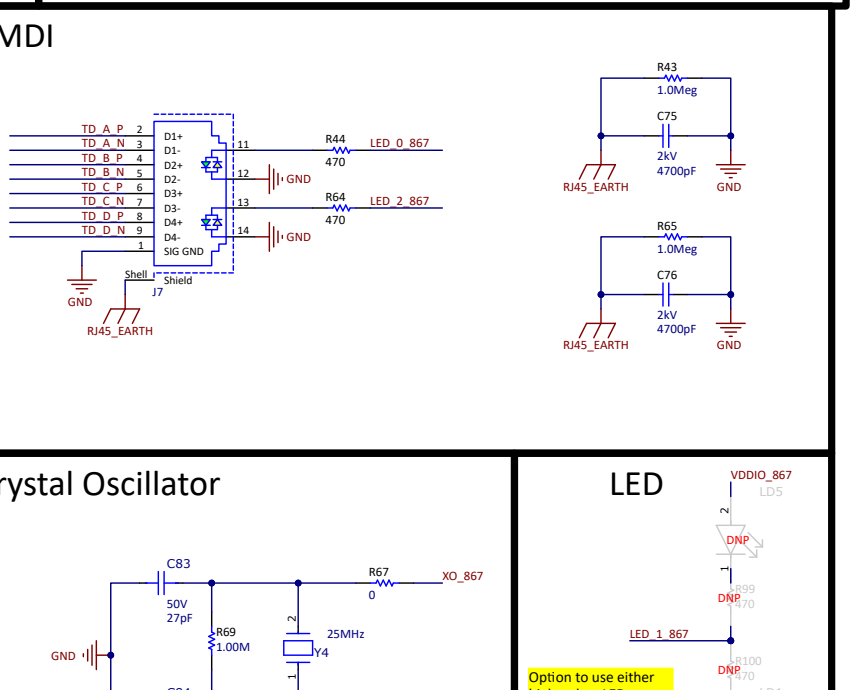












图 4-5. 原理图：DP83867

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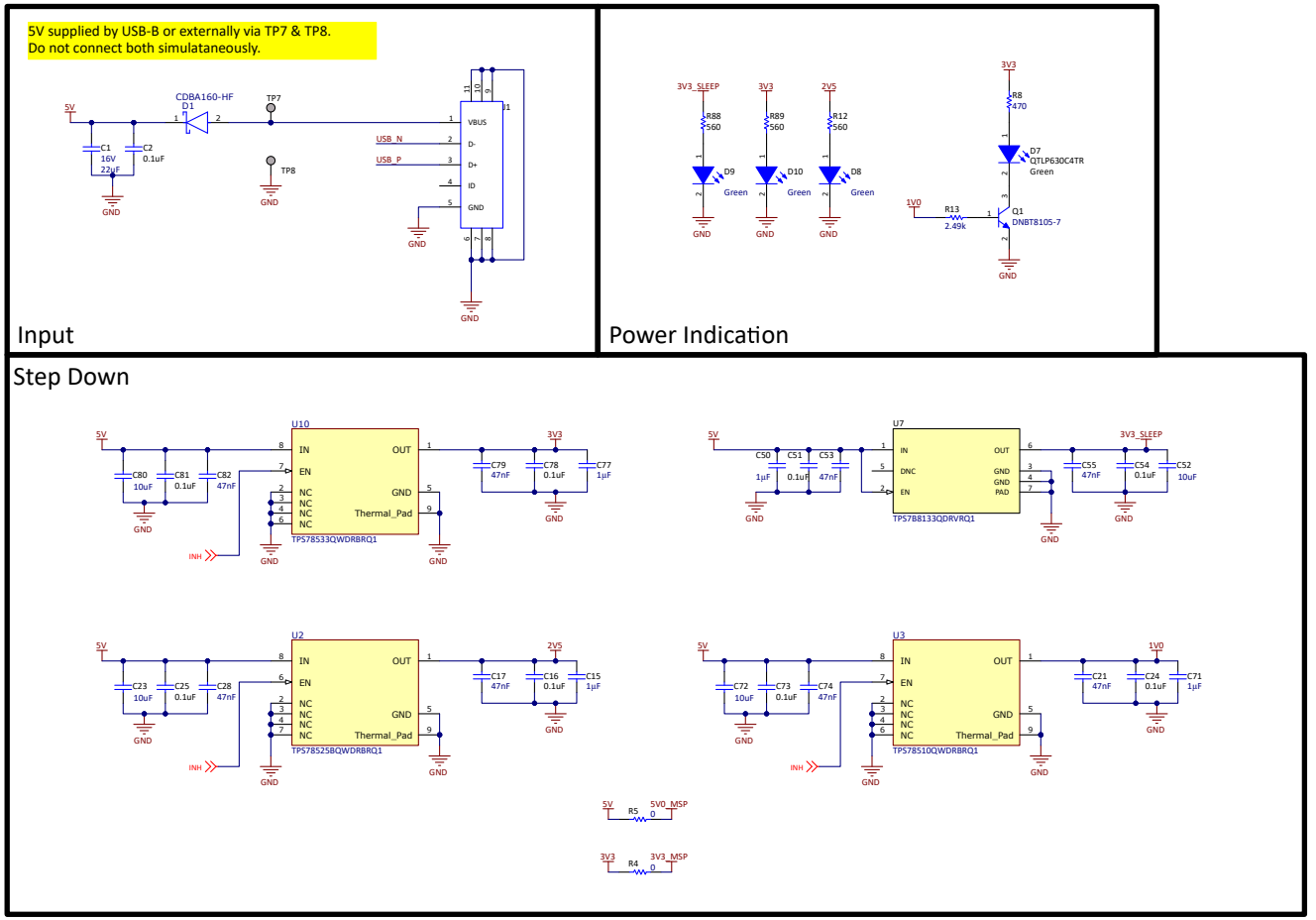



**图 4-6. 原理图：电源**



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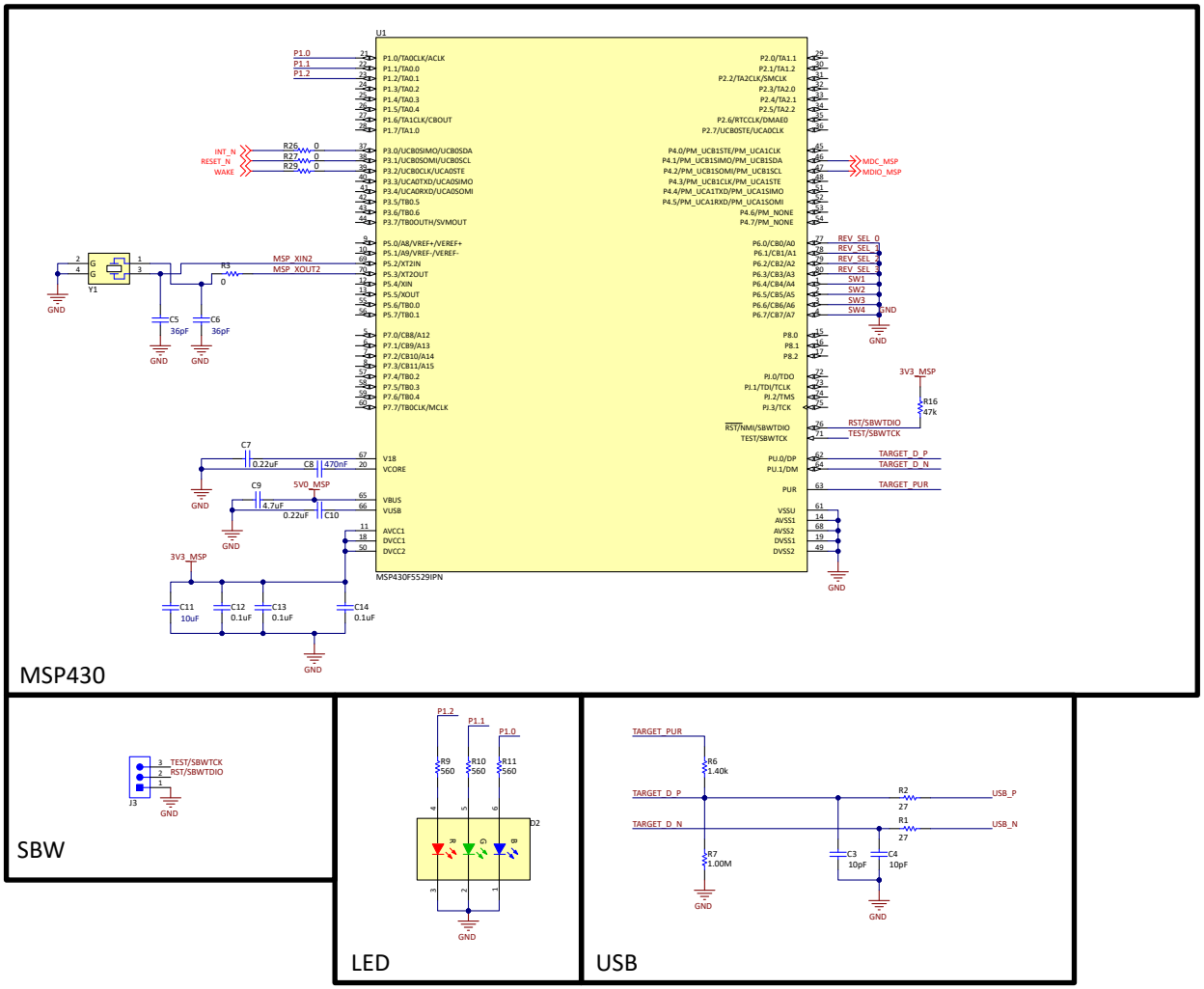



**图 4-7. 原理图：MSP430**



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### 4.2 PCB 布局

如需下载 PBC 指南和示例布局，请参阅 DP83TC110X-EVM-MC 网页。

### 4.3 物料清单 (BOM)

如需下载物料清单 (BOM)，请参阅 DP83TC110X-EVM-MC 网页。

## 5 其他信息

### 5.1 商标

MSP430™ is a trademark of Texas Instruments.
Windows® is a registered trademark of Microsoft Corporation.
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   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 DEGREDATION 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/lsds/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/lsds/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, INDEMITY 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.

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