

# TPS65053EVM-217

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## 1 Introduction

The Texas Instruments TPS65053EVM-217 evaluation module (EVM) enables designers to easily evaluate the operation and performance of the TPS65053 PMIC for applications that are powered with one Li Ion or Li Polymer cell and require multiple power rails. The TPS65053 contains two highly efficient step-down switching converters, three low dropout (LDO) linear regulators and a voltage monitor /RESET\ output.

## **2 Setup**

This chapter describes the jumpers and connectors on the EVM, as well as how to properly connect, set up, and use the TPS65053EVM-217.

### **2.1 Input/Output Connector Descriptions**

#### **J1 - VLDO1**

This is the positive output for the VLDO1 LDO linear regulator. This output is externally adjustable for the TPS65053 and comes preset to 1.6 V. The VLDO1 output is capable of supplying up to 400 mA.

#### **J2 - GND**

This is the return connection for the VLDO1 output rail.

#### **J3 - VLDO2**

This is the positive output for the VLDO2 LDO linear regulator. This output is externally adjustable for the TPS65053 and comes preset to 3.3 V. The VLDO2 output is capable of supplying up to 200 mA.

#### **J4 - GND**

This is the return connection for the VLDO2 output rail.

#### **J5 - VLDO3**

This is the positive output for the VLDO3 LDO linear regulator. This output is fixed for the TPS65053 at 1.3 V. The VLDO3 output is capable of supplying up to 200 mA.

#### **J6 - GND**

This is the return connection for the VLDO3 output rail.

#### **J7 - VOUT DCDC1**

This is the positive output for VDCDC1 step-down converter. This output is externally adjustable for the TPS65053 and comes preset to 2.85 V. VDCDC1 is capable of sourcing up to 1 A.

#### **J8 - GND**

This is the return connection for the VDCDC1 output rail.

#### **J9 - VIN**

This is the positive input voltage connection to the converter. The EVM operates from any supply voltage between 2.5 V and 6.0 V. The leads to the input supply should be twisted and kept as short as possible to minimize EMI transmission and input voltage droop.

#### **J10 - GND**

This is the input return connection for the input power supply.

#### **J11 - VOUT DCDC2**

This is the positive output for VDCDC2 step-down converter. This output is externally adjustable for the TPS65053 and comes preset to 1.8 V. VDCDC2 is capable of sourcing up to 600 mA.

#### **J12 - GND**

This is the return connection for the VDCDC2 output rail.

#### **TP1 -/RESET**

TP1 allows the user to monitor /RESET output. The /RESET output goes high 100 ms after the THRESHOLD input exceeds 1 V. /RESET goes low when the THRESHOLD input falls below 1 V. On the EVM, the /RESET circuitry monitors the input voltage. The threshold is set to a 3.3-V input.

## JP1 - MODE Input

JP1 is used to select between the forced PWM and Power Save mode (PSM) operation for the switching converters. Place a shorting bar in the PSM position to select the Power Save mode. In this mode, PFM is used for light loads, and PWM is used for heavier loads. Place a shorting bar in the PWM position to force PWM operation at all loads.

## JP2 - EN\_LDO1

JP2 is used to enable the VLDO1 output. Place a shorting bar in the ON position to turn the VLDO1 LDO converter on. Place the shorting bar in the OFF position to turn the VLDO1 LDO converter off.

## JP3 - EN\_DCDC2

JP3 is used to enable the VDCDC2 output. Place a shorting bar in the ON position to turn the VDCDC2 step-down converter on. Place a shorting bar in the OFF position to turn VDCDC2 converter off.

## JP4 - EN\_DCDC1

JP4 is used to enable the VDCDC1 output. Place a shorting bar in the ON position to turn the VDCDC1 step-down converter on. Place a shorting bar in the OFF position to turn VDCDC1 converter off.

## JP5 - EN\_LDO2

JP5 is used to enable the VLDO2 output. Place a shorting bar in the ON position to turn the VLDO2 LDO converter on. Place the shorting bar in the OFF position to turn the VLDO2 LDO converter off.

## JP6 - EN\_LDO3

JP6 is used to enable the VLDO3 output. Place a shorting bar in the ON position to turn the VLDO3 LDO converter on. Place the shorting bar in the OFF position to turn the VLDO1 LDO converter off.

## 2.2 EVM Setup

### 2.2.1 EVM Factory Configuration

The EVM is configured to provide the following nominal operating conditions:

- Input Voltage: 2.5 V to 6.0 V
- Output Voltage: See [Table 1](#)
- Maximum Load Current: See [Table 2](#)

**Table 1. EVM Preset Output Voltage**

| Output | TPS65053EVM |
|--------|-------------|
| VDCDC1 | 1.85 V      |
| VDCDC2 | 1.8 V       |
| VLDO1  | 1.6 V       |
| VLDO2  | 3.3 V       |
| VLDO3  | 1.3 V       |

**Table 2. Maximum Load Current**

| Output | TPS65053EVM |
|--------|-------------|
| VDCDC1 | 1 A         |
| VDCDC2 | 600 mA      |
| VLD01  | 400 mA      |
| VLD02  | 200 mA      |
| VLD03  | 200 mA      |

## 2.3 Operation

1. Configure all EVM jumpers to factory settings shown in [Table 3](#).
2. Connect the input voltage return to J2.
3. Connect the positive input voltage to J1.
4. Connect all loads to the outputs.
5. Turn on input voltage.

**Table 3. Factory EVM Jumper Settings**

| Jumper | Shunt Location          |
|--------|-------------------------|
|        | TPS65053EVM             |
| JP1    | Between PWM and MODE    |
| JP2    | Between ON and EN_LDO1  |
| JP3    | Between ON and EN_DCDC2 |
| JP4    | Between ON and EN_DCDC1 |
| JP5    | Between ON and EN_LDO2  |
| JP6    | Between ON and EN_LDO3  |

### 3 Board Layout

This chapter provides the TPS65053EVM-217 board layout and illustrations.

#### 3.1 Layout

Figure 1, Figure 2, and Figure 3 show the board layout for the TPS65053EVM-217 PWB.

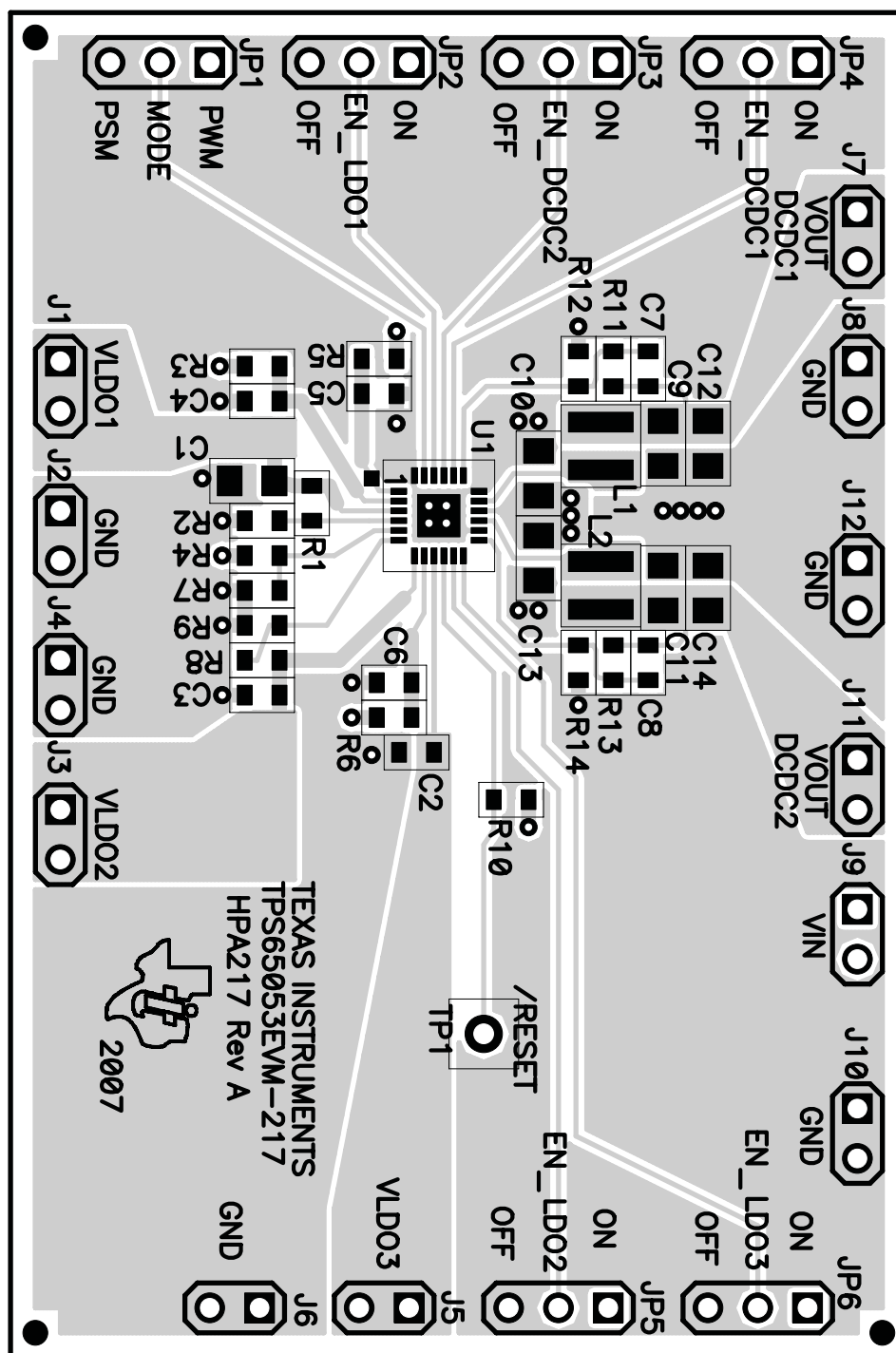


Figure 1. Assembly Layer

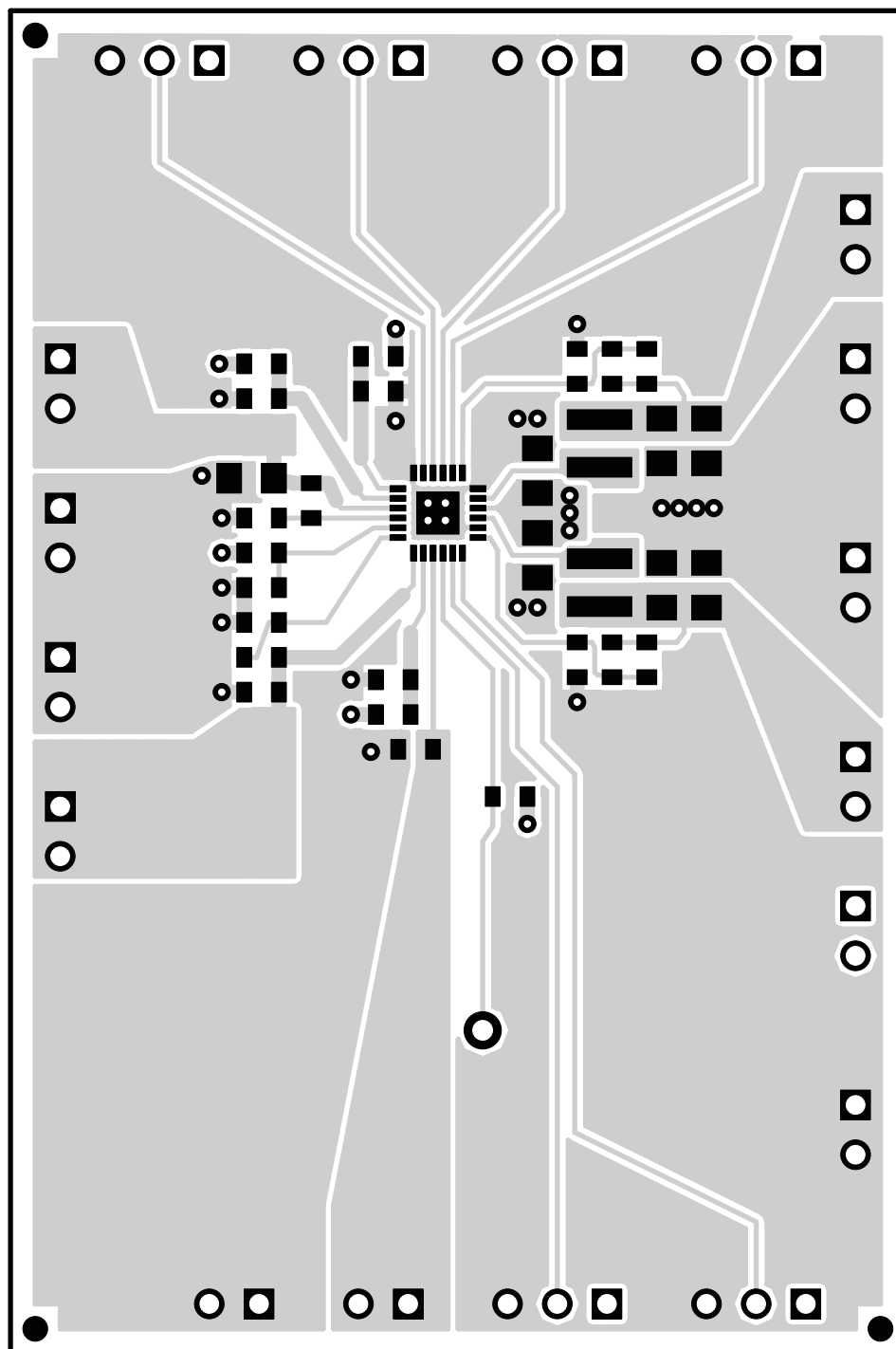


Figure 2. Top Layer Routing

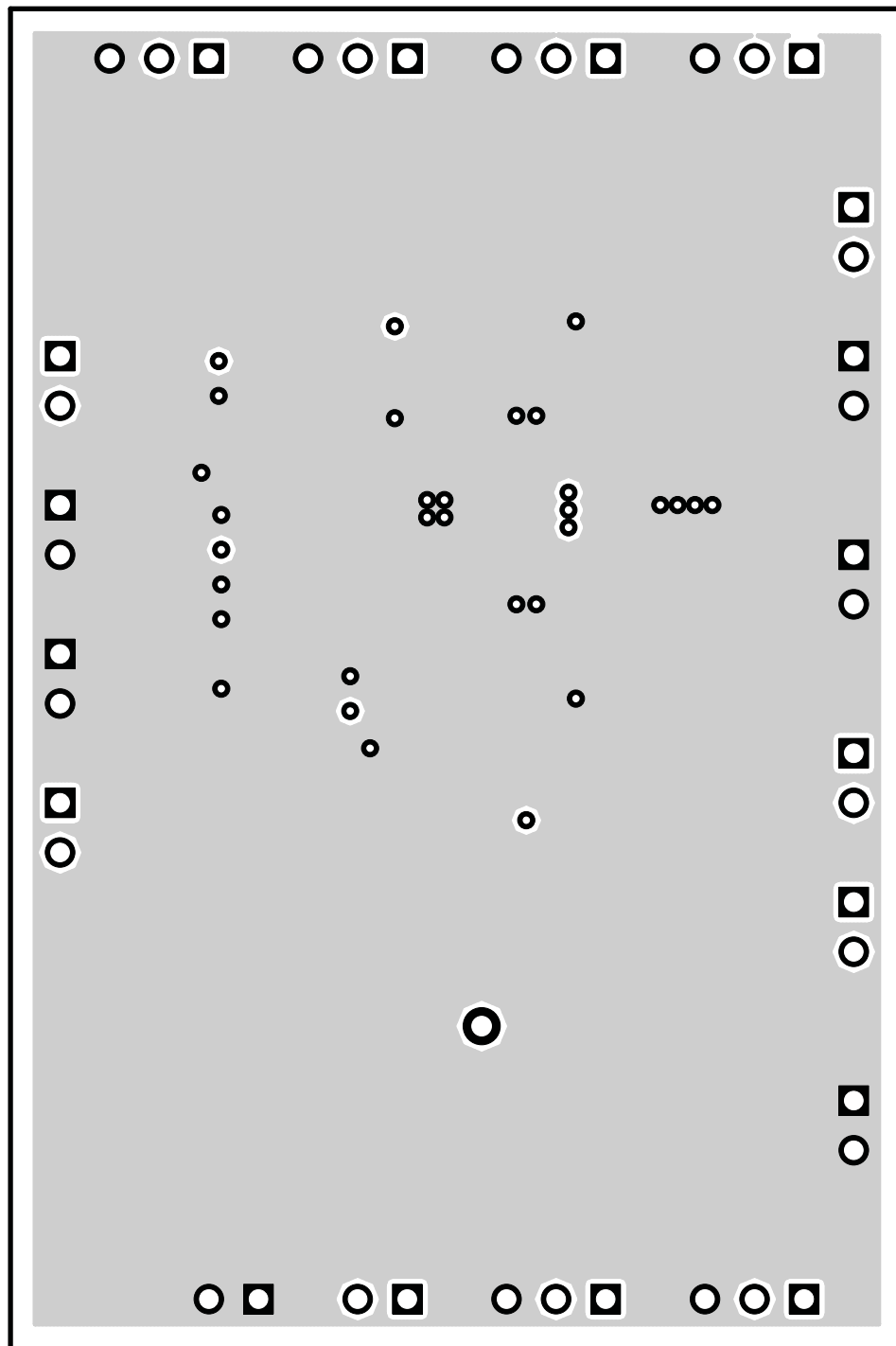


Figure 3. Inner Layer 2 Routing

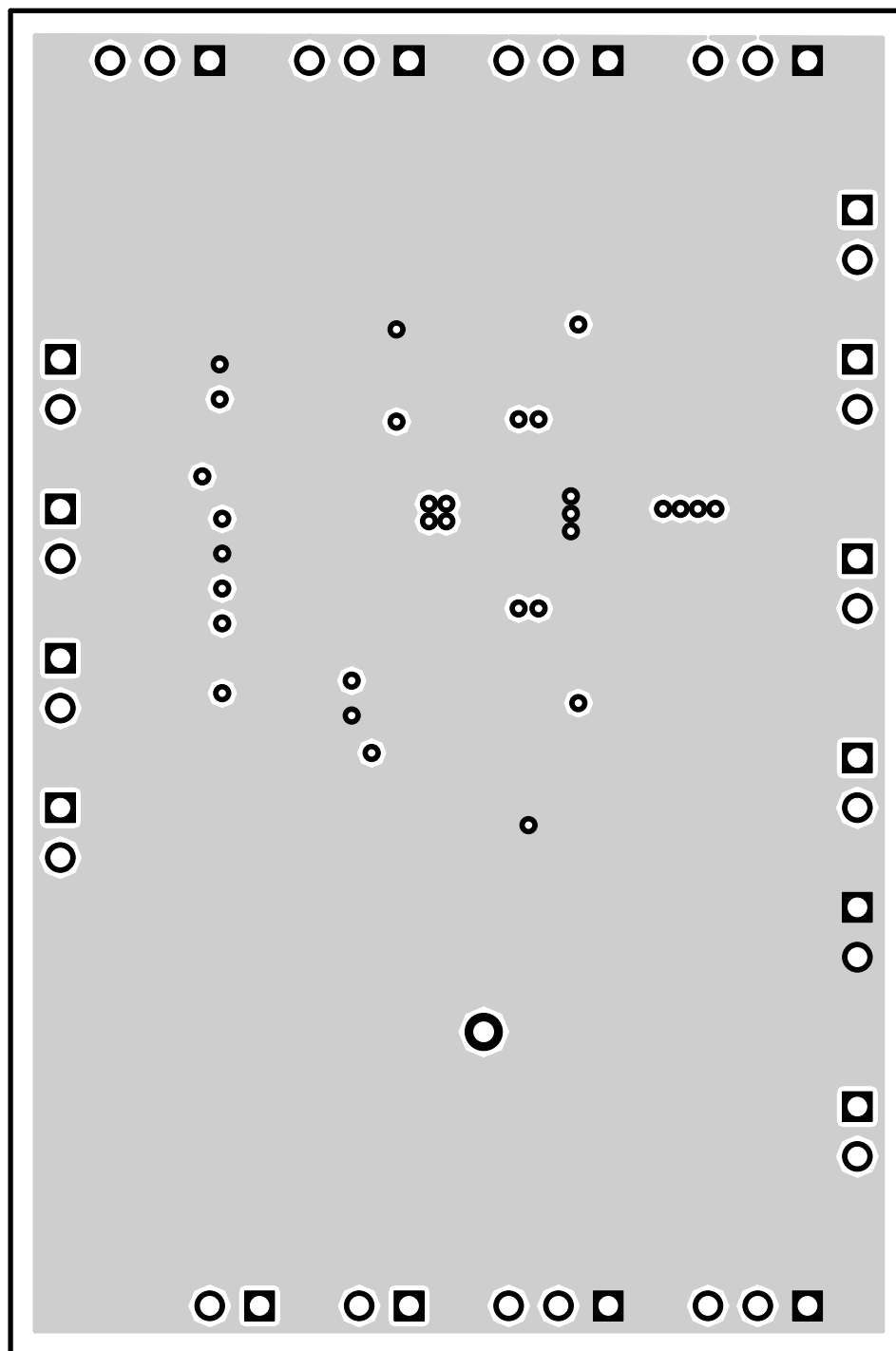


Figure 4. Inner Layer 3 Top Layer Routing



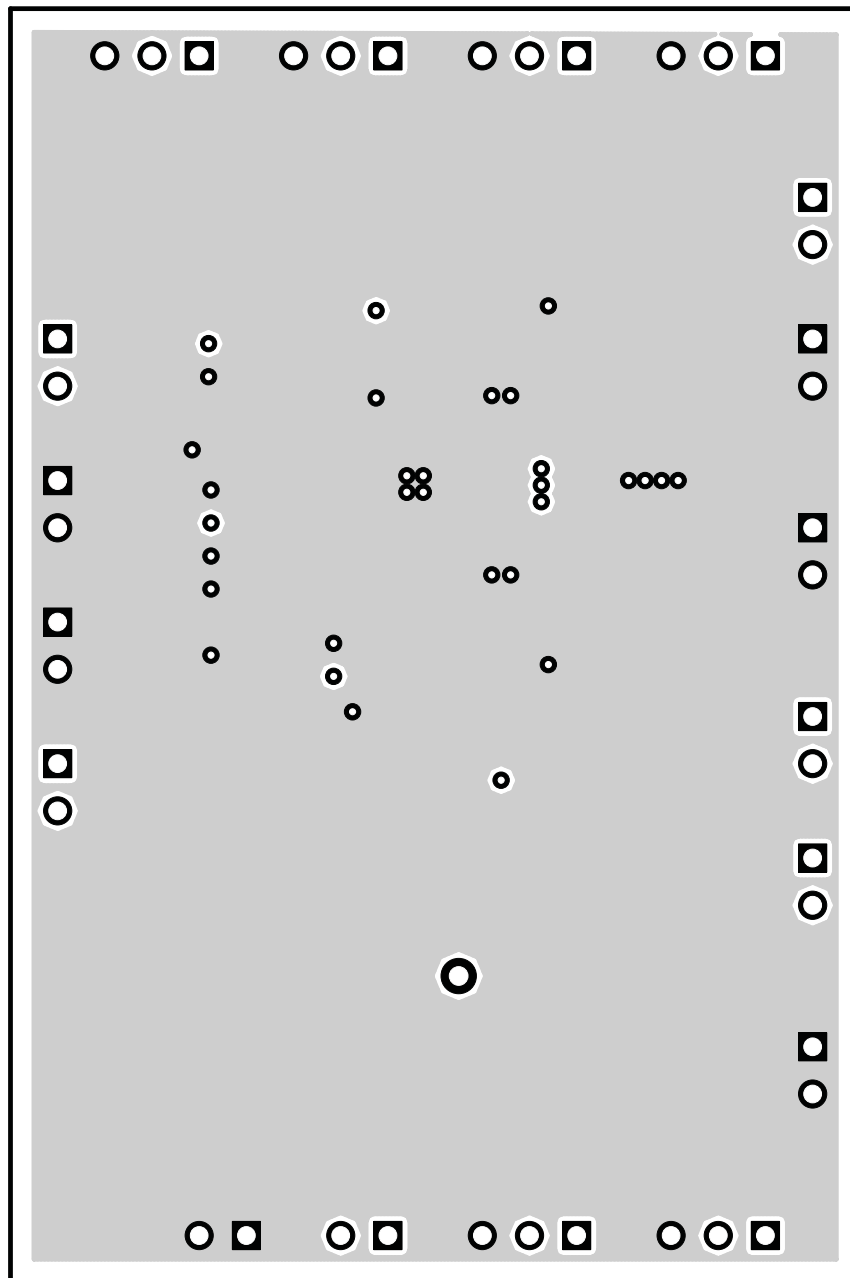


Figure 5. Bottom Layer Routing

## **4 Schematic and Bill of Materials**

This chapter provides the TPS65053EVM-217 schematic and bill of materials.

## 4.1 Schematic

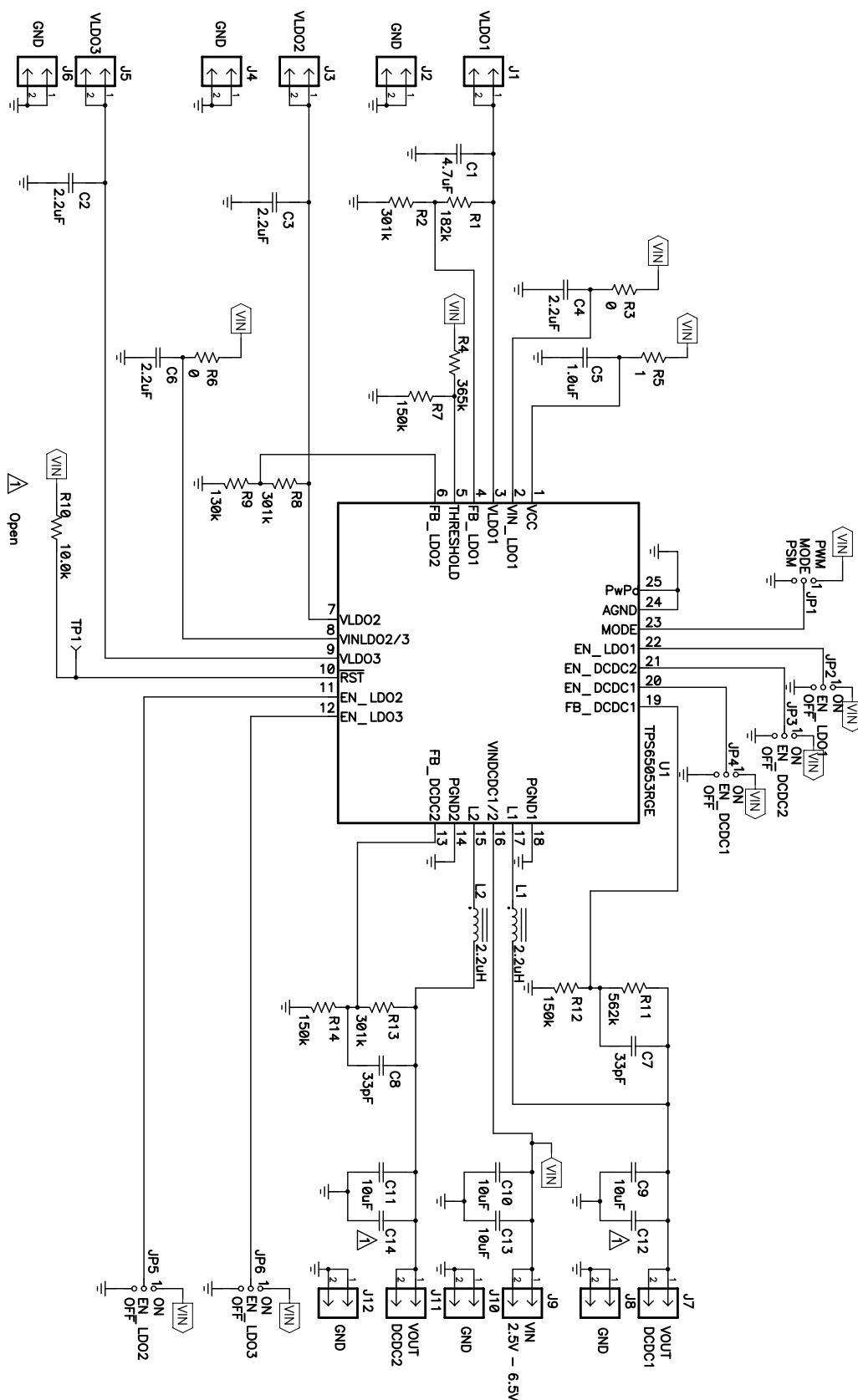


Figure 6. TPS65053EVM-217 Schematic

## 4.2 Bill of Materials

**Table 4. TPS65053EVM-217 Bill of Materials**

| Count | RefDes            | Value       | Description                                                         | Size                 | Part Number        | MFR       |
|-------|-------------------|-------------|---------------------------------------------------------------------|----------------------|--------------------|-----------|
| 1     | C1                | 4.7 $\mu$ F | Capacitor, Ceramic, 10V, X5R, 10%                                   | 0805                 | GRM219R61A475KE19D | muRata    |
| 0     | C12,C14           | Open        | Capacitor, Ceramic                                                  | 0805                 |                    |           |
| 4     | C2, C3, C4, C6    | 2.2 $\mu$ F | Capacitor, Ceramic, 10V, X5R, 10%                                   | 0603                 | GRM188R61A225KE34D | muRata    |
| 1     | C5                | 1.0 $\mu$ F | Capacitor, Ceramic, 16V, X7R, 10%                                   | 0603                 | C1608X7R1C105K     | TDK       |
| 2     | C7, C8            | 33 pF       | Capacitor, Ceramic, 50V, C0G, 5%                                    | 0603                 | C1608C0G1H330J     | TDK       |
| 4     | C9, C10, C11, C13 | 10 $\mu$ F  | Capacitor, Ceramic, 10V, X5R, 10%                                   | 0805                 | GRM21BR61A106KE19L | muRata    |
| 12    | J1–J12            |             | Header, 2 pin, 100mil spacing, (36-pin strip)                       | 0.100 $\times$ 2     | PTC36SAAN          | Sullins   |
| 6     | JP1–JP6           |             | Header, 3 pin, 100mil spacing, (36-pin strip)                       | 0.100 $\times$ 3     | PTC36SAAN          | Sullins   |
| 2     | L1, L2            | 2.2 $\mu$ H | Inductor, SMT, 1.5A, 110milliohm                                    | 0.118 $\times$ 0.118 | LPS3015-222ML      | Coilcraft |
| 1     | R1                | 182 k       | Resistor, Chip, 1/16W, 1%                                           | 0603                 | Std                | Std       |
| 1     | R10               | 10.0 k      | Resistor, Chip, 1/16W, 1%                                           | 0603                 | Std                | Std       |
| 1     | R11               | 562 k       | Resistor, Chip, 1/16W, 1%                                           | 0603                 | Std                | Std       |
| 3     | R2, R8, R13       | 301 k       | Resistor, Chip, 1/16W, 1%                                           | 0603                 | Std                | Std       |
| 2     | R3, R6            | 0           | Resistor, Chip, 1/16W, 5%                                           | 0603                 | Std                | Std       |
| 1     | R4                | 365 k       | Resistor, Chip, 1/16W, 1%                                           | 0603                 | Std                | Std       |
| 1     | R5                | 1           | Resistor, Chip, 1/16W, 5%                                           | 0603                 | Std                | Std       |
| 3     | R7, R12, R14      | 150 k       | Resistor, Chip, 1/16W, 1%                                           | 0603                 | Std                | Std       |
| 1     | R9                | 130 k       | Resistor, Chip, 1/16W, 1%                                           | 0603                 | Std                | Std       |
| 1     | TP1               |             | Test Point, Red, Thru Hole Color Keyed                              | 0.100 $\times$ 0.100 | 5000               | Keystone  |
| 1     | U1                |             | IC, 2.25 MHz Dual Step-down Converter With 3 Low Input Voltage LDOs | QFN24                | TPS65053RGE        | TI        |
| 1     | --                |             | PCB, 2.7 in $\times$ 1.8 in $\times$ 0.062 in                       |                      | HPA217             | Any       |
| 6     | --                |             | Shunt, 100mil, Black                                                | 0.100                | 929950-00          | 3M        |

## Related Documentation From Texas Instruments

TPS65053 data sheet (SLVS754)

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### EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 0 V to 6 V and the output voltage range of 0.6 V to  $V_{INXX}$ .

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. 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 100°C. The EVM is designed to operate properly with certain components above 100°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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