

## ***TPS7A66xx EVM Evaluation Module (EVM)***

The Texas Instruments TPS7A66xx EVM <sup>(1)</sup> evaluation module (EVM) helps designers evaluate the operation and performance of the TPS7A66xx EVM linear regulator.

The EVM contains one linear regulator (See [Table 1](#)).

<sup>(1)</sup> Where xx is 01 for adjustable 1.5-V to 5-V output, 33 for 3.3-V output, and 50 for 5-V output.

**Table 1. Device and Package Configurations**

| REGULATOR | IC               | PACKAGE |
|-----------|------------------|---------|
| U1        | TPS7A6601QDGNRQ1 | MSOP-8  |
| U1        | TPS7A6633QDGNRQ1 | MSOP-8  |
| U1        | TPS7A6650QDGNRQ1 | MSOP-8  |

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## 1 Setup

This section describes the jumpers and connectors on the EVM as well and how properly to connect, set up, and use the TPS7A66xx EVM.

### 1.1 Input and Output Connector Descriptions

**GND** is the ground return for the regulator. The EVM provides three GND test points to allow the user to power the EVM, connect the load, and attach an oscilloscope ground lead.

**J1** is a jumper used for choosing the power applied at the EN pin; having pin 1 and pin 2 connected pulls EN down to GND and disables the device. With pin 2 and pin 3 connected, the voltage at EN equals the input voltage.

**NC** is a redundant pin which one can leave open.

**TP\_EN** is a power test point. The test point allows the user to measure the input voltage at the EN pin. The user can also apply power to this test point directly.

**TP\_FB** is a power test point. The test point is available in adjustable-version LDO TPS7A6601 only, and allows the user to measure the internal reference voltage. When adjustable-version device TPS7A6601 is soldered on the EVM, the resistor divider on the board sets the output voltage to 1.5 V.

**TP\_PG** is a power test point which allows the user to monitor the status of the PG pin.

**TP\_Vin** is a power test point. The test point allows the user to measure the input voltage after the reverse-battery protection diode. The user can also apply power to the regulator through this test point.

**TP\_Vout** is a power test point; this test point allows the user to measure the output voltage at the Vout pin. The user can also attach a load to the EVM through this pin.

**Vin** is the protected power input for the regulator. The test point provides a power (Vin) connection and a reverse-battery protection diode to allow the user to power the EVM.

**Vout** is power output for the regulator. The test point provides a connection to attach a load to the EVM.

### 1.2 Setup

The input voltage range for the converter is 5.5 V to 40 V. The EVM can support up to 150 mA of load current. Setup steps follow:

1. Short pin 2 and pin 3 of J1.
2. Set the input voltage supply voltage to 12 V and set the current limit to 0.8 A.
3. Connect the input power supply positive lead to Vin and the return lead to GND.
4. Apply the load between Vout and GND.

### 1.3 Operation

The TPS7A66xx EVM powers up after the VBAT voltage has exceeded the power-on-reset threshold.

The PCB offers a footprint for the TPS7A66xxQDGNRQ1 device.

## 2 Board Layout

[Figure 1](#), [Figure 2](#) and [Figure 3](#) show the board layout for the TPS7A66xx EVM PWB.

The large number of vias beneath the device footprint help to enhance thermal performance. The device pins require soldered attachment to the copper landing on the PCB for optimal performance. The PCB provides 2-oz. (0.071-mm thick) copper planes on the top and bottom to dissipate heat.

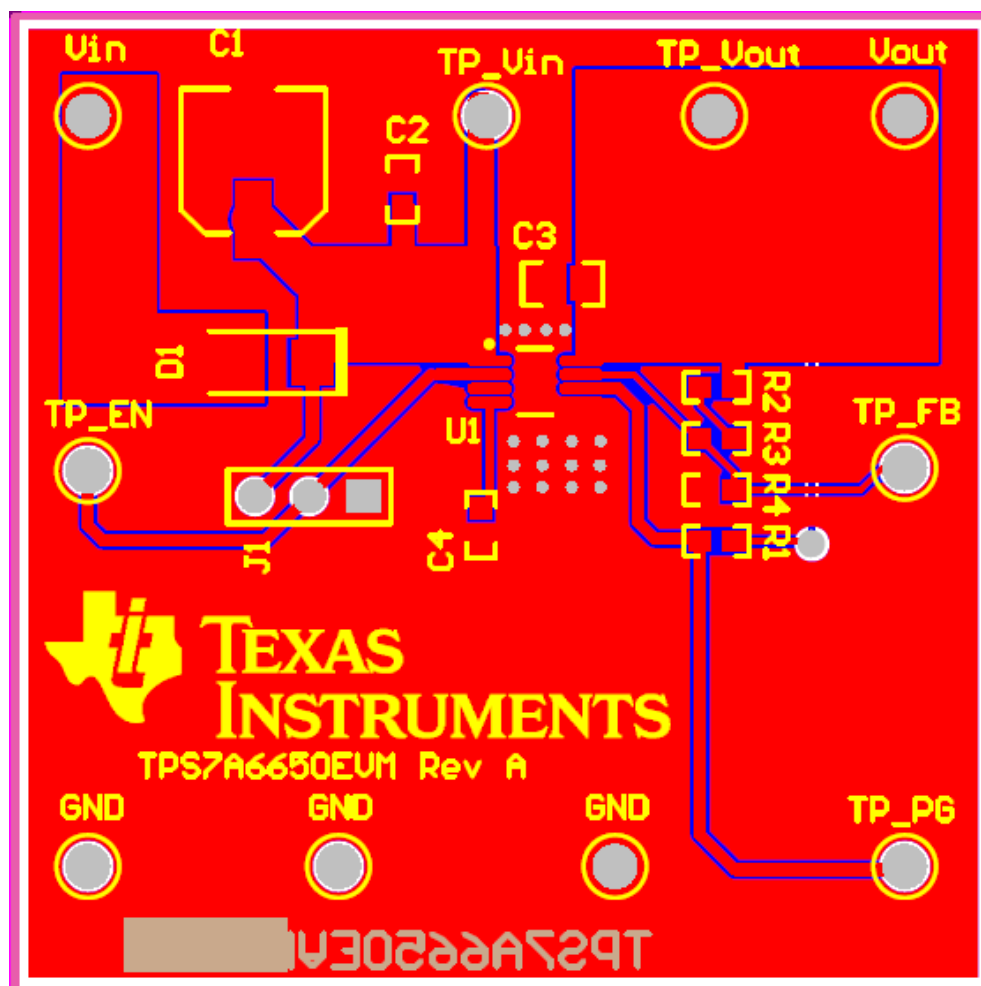
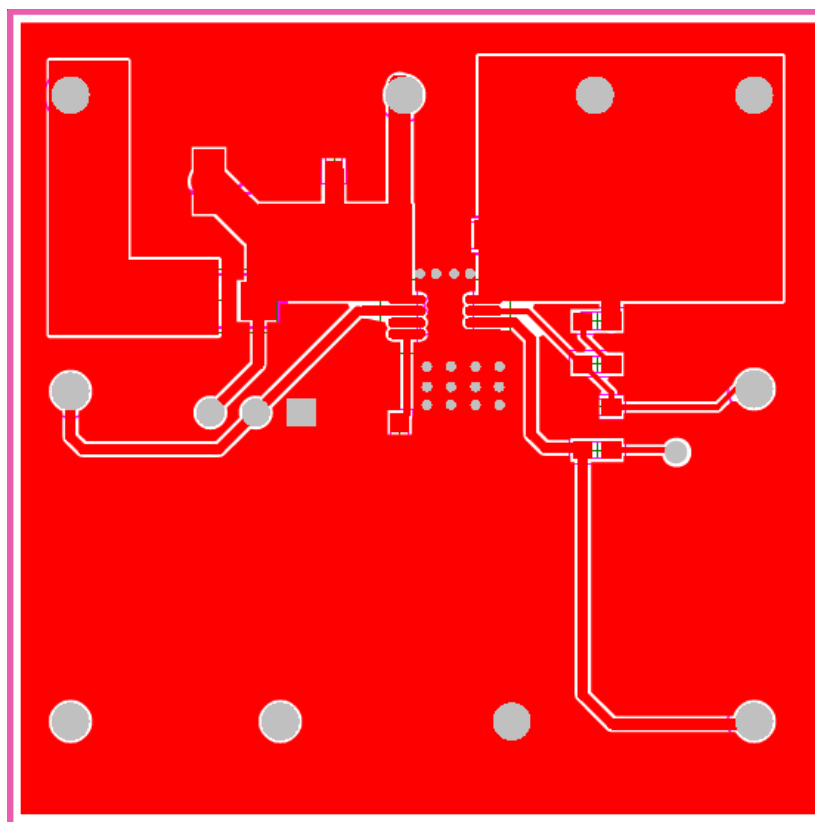


Figure 1. Top Assembly Layer



**Figure 2. Top Layer Routing**

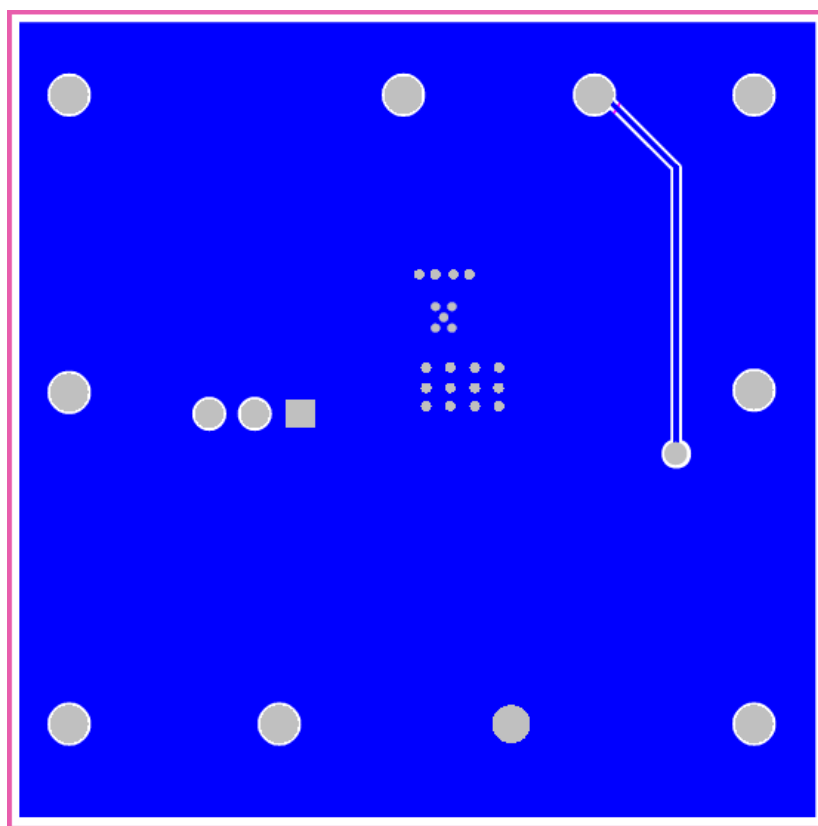


Figure 3. Bottom Layer Routing

## 3 Schematic and Bill of Materials

### 3.1 Schematic

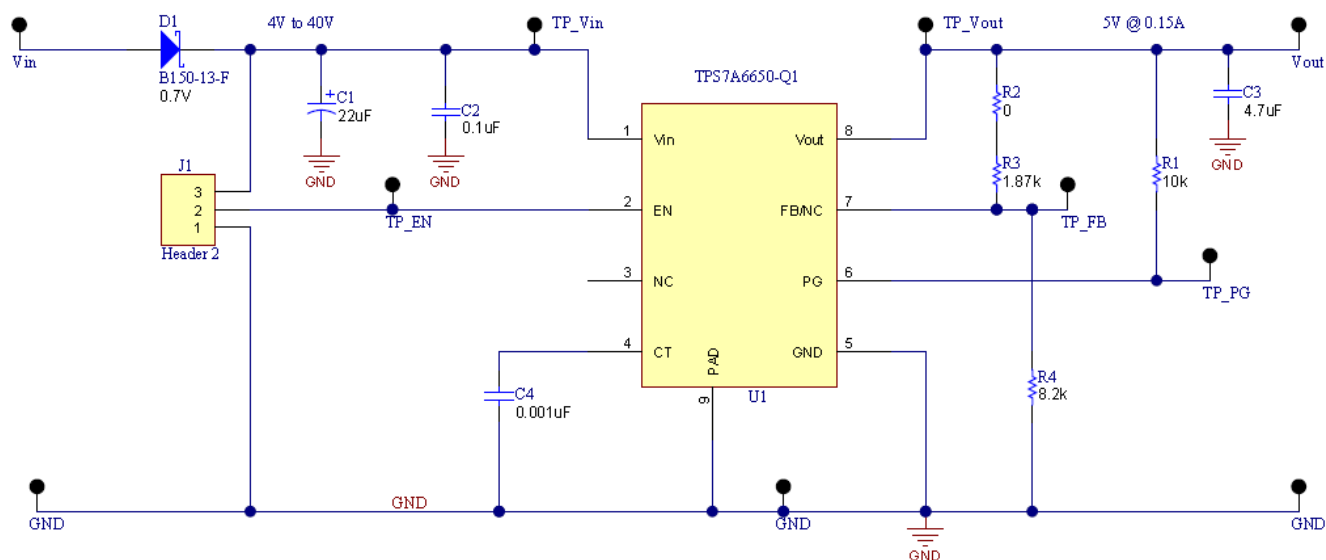


Figure 4. TPS7A66xx EVM Schematic

## 3.2 Bill of Materials

**Table 2. Bill of Materials**

| Designator                                                              | Qty. | Part Number        | Description                                                    | Manufacturer     |
|-------------------------------------------------------------------------|------|--------------------|----------------------------------------------------------------|------------------|
| C1                                                                      | 1    | EMVH500ADA220MF80G | Capacitor, AL, 22- $\mu$ F, 50-V, $\pm$ 20%, 2- $\Omega$ , SMD | Nippon Chemi-Con |
| C2                                                                      | 1    | GRM188R71H104KA93D | Capacitor, CERM, 0.1- $\mu$ F, 50-V, $\pm$ 10%, X7R, 0603      | MuRata           |
| C3                                                                      | 1    | GRM219R61A475KE34D | Capacitor, CERM, 4.7- $\mu$ F, 10-V, $\pm$ 10%, X5R, 0805      | MuRata           |
| C4                                                                      | 1    | 06035A102KAT2A     | Capacitor, CERM, 1000-pF, 50-V, $\pm$ 10%, C0G/NP0, 0603       | AVX              |
| D1                                                                      | 1    | B150-13-F          | Diode, Schottky, 50-V, 1-A, SMA                                | Diodes Inc.      |
| GND, GND, GND,<br>TP_EN, TP_FB,<br>TP_PG, TP_Vin,<br>TP_Vout, Vin, Vout | 10   | 5001               | Test point, TH, miniature, black                               | Keystone         |
| J1                                                                      | 1    | 901200123          | 3-pin 2.54-mm pitch header                                     | Molex            |
| PCB                                                                     | 1    | HVL044             | Printed-circuit board                                          |                  |
| R1                                                                      | 1    | CRCW060310K0JNEA   | Resistor, 10-k $\Omega$ , 5%, 0.1-W, 0603                      | Vishay-Dale      |
| R2                                                                      | 1    | CRCW06030000Z0EA   | Resistor, 0- $\Omega$ , 5%, 0.1-W, 0603                        | Vishay-Dale      |
| R3                                                                      | 1    | CRCW06031K87FKEA   | Resistor, 1.87-k $\Omega$ , 1%, 0.1-W, 0603                    | Vishay-Dale      |
| R4                                                                      | 1    | CRCW06038K20JNEA   | Resistor, 8.2-k $\Omega$ , 5%, 0.1-W, 0603                     | Vishay-Dale      |
| U1                                                                      | 1    | TPS7A66xx-Q1       | IC, 150-mA high-voltage ultralow-Iq low-dropout regulator      | TI               |

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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.

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**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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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.

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|                               |                                                                                          |
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| Energy and Lighting           | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
| Industrial                    | <a href="http://www.ti.com/industrial">www.ti.com/industrial</a>                         |
| Medical                       | <a href="http://www.ti.com/medical">www.ti.com/medical</a>                               |
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