

## **TPS82130EVM-720, TPS82140EVM-720, and TPS82150EVM-720 Evaluation Modules**

The PWR720 evaluation module (EVM) facilitates the evaluation of the TPS82130/40/50 MicroSiP™ power modules. The device outputs a 1.8-V output voltage at up to 3-A of output current from input voltages between 3 V and 17 V.

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## 1 Introduction

The TPS82130 is a 3-A, synchronous, step-down module in a 2.8- x 3.0- x 1.53-mm package. The inductor and IC are included in the device. The TPS82140 and TPS82150 are pin-to-pin compatible power modules supporting lower output currents. See [Table 1](#) for a summary of the PWR720 EVMs.

**Table 1. PWR720 EVM Options**

Orderable EVM Number	IC Part Number	Maximum Output Current
TPS82130EVM-720 (PWR720-001)	TPS82130	3000 mA
TPS82140EVM-720 (PWR720-002)	TPS82140	2000 mA
TPS82150EVM-720 (PWR720-003)	TPS82150	1000 mA

## 1.1 Performance Specification

Table 2 provides a summary of the PWR720 EVM performance specifications.

**Table 2. Performance Specification Summary**

Specification	Test Conditions	Min	Typ	Max	Unit
Input Voltage		3		17	V
Output Voltage Setpoint			1.8		V
Output Current	TPS82130EVM-720	0		3000	mA
Output Current	TPS82140EVM-720	0		2000	mA
Output Current	TPS82150EVM-720	0		1000	mA

## 1.2 Thermal Data

Table 3 shows the PWR720 EVM thermal data after considering the printed-circuit board (PCB) design of real applications. Compared to the JEDEC values listed in the data sheet, the PWR720 EVM design uses thicker copper on the 2 internal layers, has bigger planes connecting to the IC, and uses a thinner PCB. These improve the thermal performance. But the PCB is smaller than the standard JEDEC PCB, and this decreases the thermal performance. Overall, these differences improve the thermal performance and more closely match a real end application.

**Table 3. PWR720 EVM Thermal Data**

Thermal Metric <sup>(1)</sup>		TPS821x0EVM-720	TPS821x0 Data Sheet (JEDEC 51-5)	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance	46.1	58.2	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	9.4	9.4	
$R_{\theta JB}$	Junction-to-board thermal resistance	14.4	14.4	
$\Psi_{JT}$	Junction-to-top characterization parameter	0.9	0.9	
$\Psi_{JB}$	Junction-to-board characterization parameter	14.0	14.2	
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	21.3	21.3	

<sup>(1)</sup> For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

## 1.3 Modifications

The PCB for this EVM is designed to accommodate some modifications by the user. Additional input and output capacitors can be added.

### 1.3.1 Input and Output Capacitors

C5 is provided for an additional input capacitor. This capacitor is not required for proper operation but can be used to reduce the input voltage ripple.

C6, C7, and C8 are provided for additional output capacitors. These capacitors are not required for proper operation but can be used to reduce the output voltage ripple and to improve the load transient response. The total output capacitance must remain within the recommended range in the data sheet for proper operation.

## 2 Setup

This section describes how to properly use the PWR720 EVM.

### 2.1 Input/Output Connector Descriptions

<b>J1 – VIN</b>	Positive input connection from the input supply for the EVM
<b>J2 – S+/S-</b>	Input voltage sense connections. Measure the input voltage at this point.
<b>J3 – GND</b>	Return connection from the input supply for the EVM
<b>J4 – VOUT</b>	Output voltage connection
<b>J5 – S+/S-</b>	Output voltage sense connections. Measure the output voltage at this point.
<b>J6 – GND</b>	Output return connection
<b>J7 – PG/GND</b>	The PG output appears on pin 1 of this header with a convenient ground on pin 2.
<b>J8 – SS/TR &amp; GND</b>	The SS/TR input appears on pin 1 of this header with a convenient ground on pin 2.
<b>JP1 – EN</b>	EN pin input jumper. Place the supplied jumper across ON and EN to turn on the IC. Place the jumper across OFF and EN to turn off the IC.
<b>JP2 – PG Pullup Voltage</b>	PG pin pullup voltage jumper. Place the supplied jumper on JP2 to connect the PG pin pullup resistor to Vout. Alternatively, the jumper can be removed and a different voltage can be supplied on pin 2 to pull up the PG pin to a different level. This externally applied voltage should remain below 6 V.

### 2.2 Setup

To operate the EVM, set jumpers JP1 and JP2 to the desired position per [Section 2.1](#). Connect the input supply to J1 and J3 and connect the load to J4 and J6.

## 3 PWR720 EVM Test Results

The PWR720 EVM was used to take all the data in the TPS821x0 data sheet ([SLVSCY5](#), [SLVSDN3](#), or [SLVSDN4](#)). See the device data sheet for the performance of this EVM.

**WARNING**



**Hot surface. Contact may cause burns. Do not touch!**

## 4 Board Layout

This section provides the PWR720 EVM board layout and illustrations in [Figure 1](#) through [Figure 6](#). The Gerbers are available on the EVM product page: [TPS82130EVM-720](#), [TPS82140EVM-720](#), or [TPS82150EVM-720](#). Rev B of the PCB just corrected typographical errors in the A version.

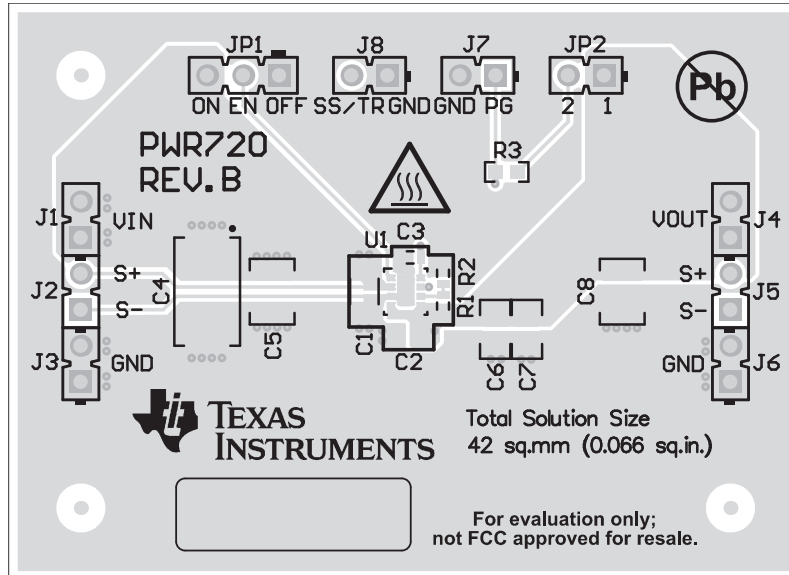


Figure 1. Top Assembly

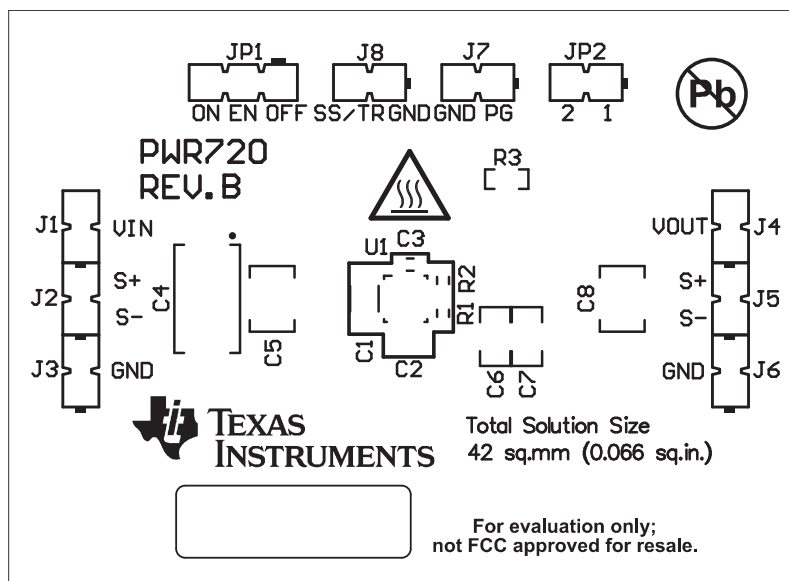


Figure 2. Top Overlay

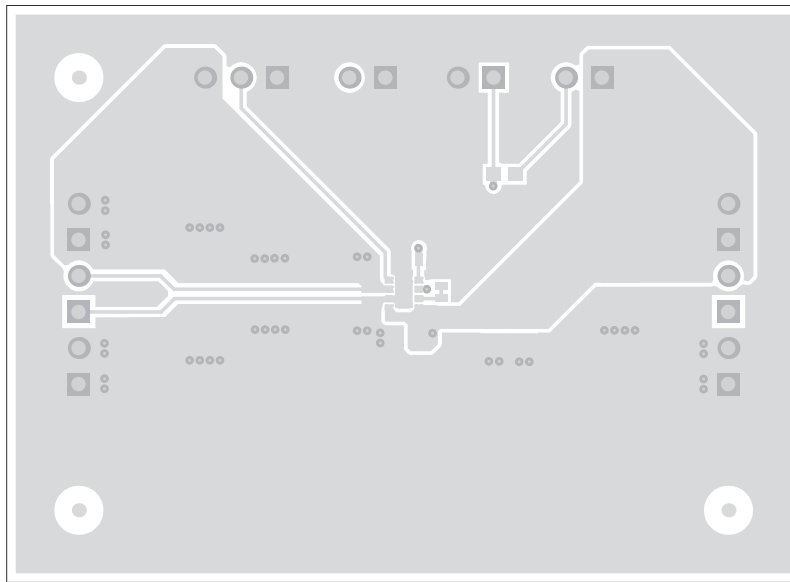


Figure 3. Top Layer

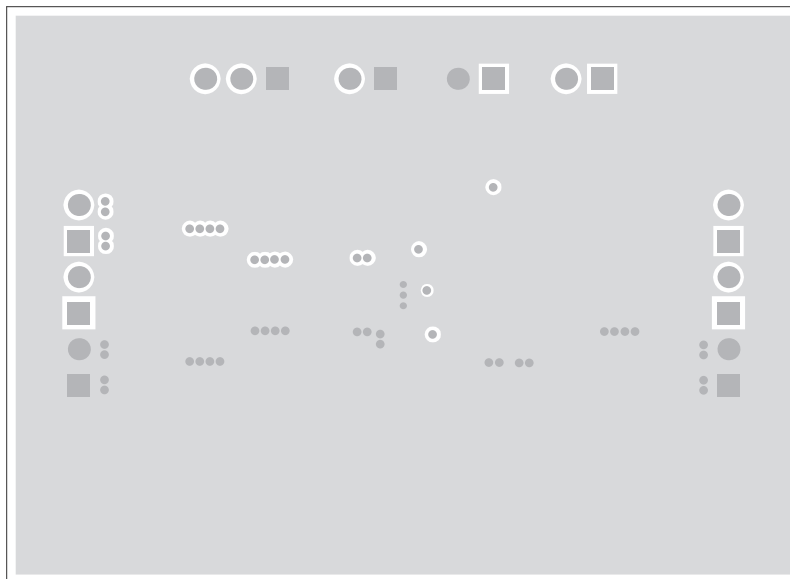
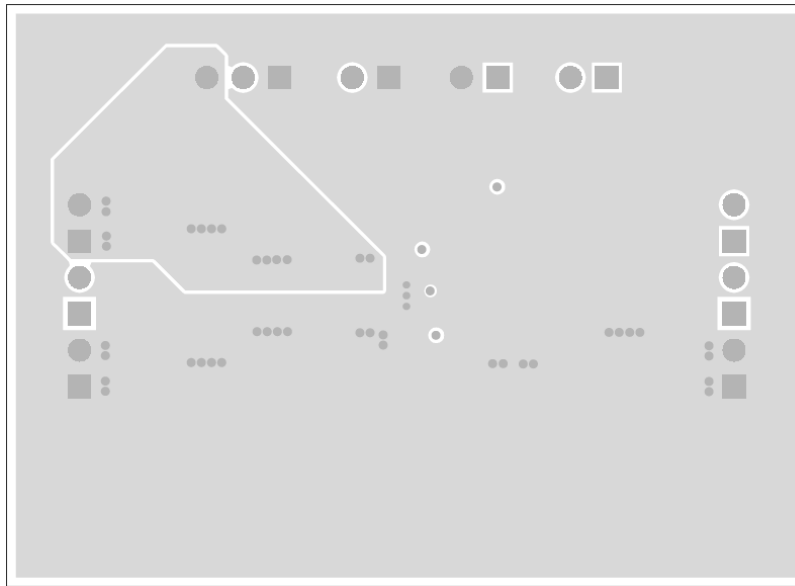
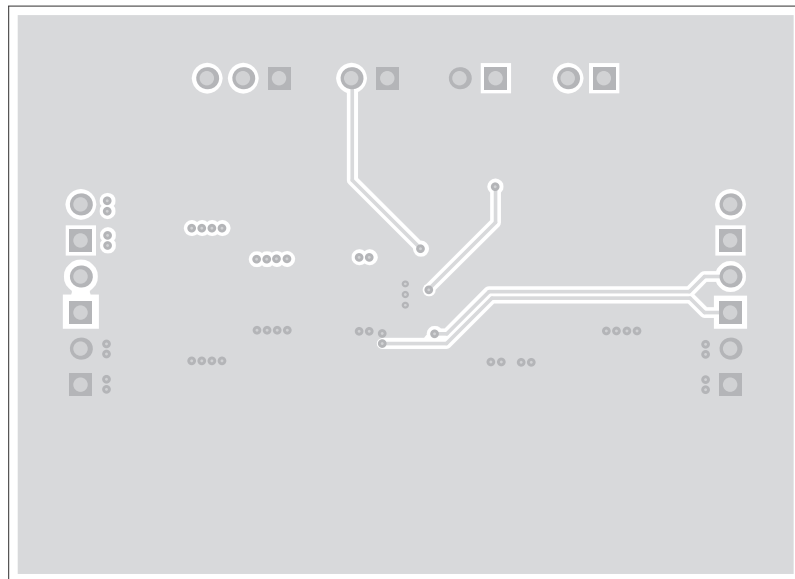


Figure 4. Internal Layer 1



**Figure 5. Internal Layer 2**



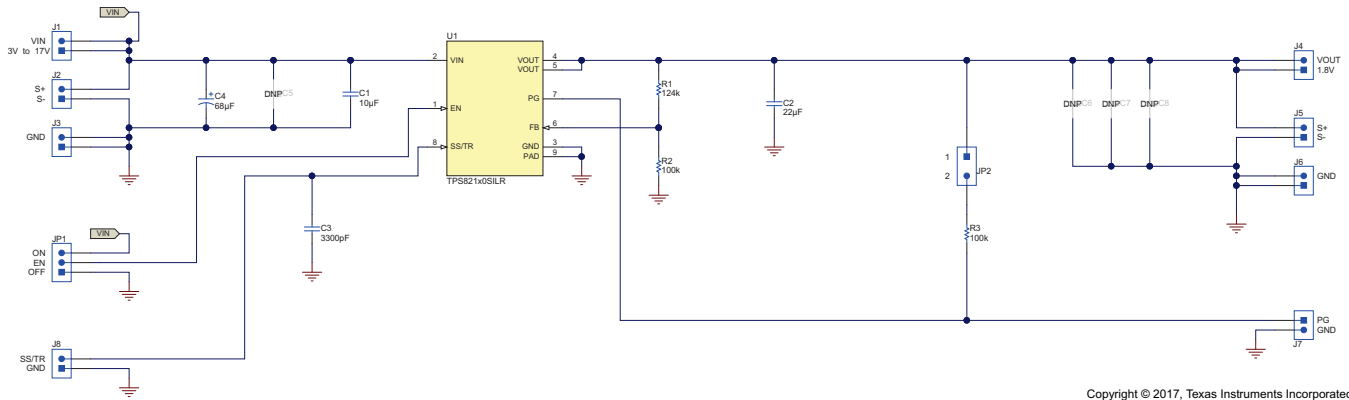
**Figure 6. Bottom Layer**

## 5 Schematic and Bill of Materials

This section provides the PWR720 EVM schematic and bill of materials (BOM).

### 5.1 Schematic

Figure 7 illustrates the EVM schematic.



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Figure 7. PWR720 EVM Schematic

### 5.2 Bill of Materials

Table 4 lists the BOM for this EVM.

Table 4. PWR720 EVM Bill of Materials

Count			Ref Des	Value	Description	Size	Part Number	Manufacturer
-001	-002	-003						
1	1	1	C1	10 $\mu$ F	CAP, CERM, 10 $\mu$ F, 25 V, +/- 20%, X7R	1206	C3216X7R1E106M160AE	TDK
1	1	1	C2	22 $\mu$ F	CAP, CERM, 22 $\mu$ F, 10 V, +/- 20%, X7S	0805	C2012X7S1A226M125AC	TDK
1	1	1	C3	3300 pF	CAP, CERM, 3300 pF, 50 V, +/- 5%, COG/NP0, 0603	0603	Std	Std
1	1	1	C4	68 $\mu$ F	CAP, TA, 68 $\mu$ F, 25 V, +/- 20%, 0.125 ohm, SMD	7343-43	TPSE686M025R0125	AVX
1	1	1	R1	124 k	RES, 124 k, 1%, 0.1 W, 0603	0603	Std	Std
2	2	2	R2, R3	100 k	RES, 100 k, 1%, 0.1 W, 0603	0603	Std	Std
1	0	0	U1	TPS82130	3A, High Efficiency Step Down MicroSiP Module with Integrated Inductor	3 x 2.8 mm	TPS82130SIL	Texas Instruments
0	1	0	U1	TPS82140	2A, High Efficiency Step Down MicroSiP Module with Integrated Inductor	3 x 2.8 mm	TPS82140SIL	Texas Instruments
0	0	1	U1	TPS82150	1A, High Efficiency Step Down MicroSiP Module with Integrated Inductor	3 x 2.8 mm	TPS82150SIL	Texas Instruments

### Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

#### Changes from A Revision (June 2016) to B Revision

Page

- EVM user's guide revision B supports the addition of TPS82140EVM-720 and TPS82150EVM-720. .... 1
- Added *PWR720 EVM Options* table. .... 1
- Changed *Performance Specification Summary* table to include TPS82140EVM-720 and TPS82150EVM-720. .... 2
- Changed schematic to a generic device name - TPS821x0SILR, from TPS82130SILR. .... 7
- Changed *PWR720 EVM Bill of Materials* table to include TPS82140EVM-720 and TPS82150EVM-720..... 7

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    - 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.

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*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.

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[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)

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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.

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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.

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