

## MAX20458 Evaluation Kit

Evaluates: MAX20458

### General Description

The MAX20458 evaluation kit (EV kit) is a fully assembled and tested application circuit that simplifies the evaluation of the MAX20458 400kHz/2.1MHz, 36V boost controller and buck converter in a 28-pin side-wettable TQFN package. All installed components are rated for the automotive temperature range. Various test points and jumpers are included for evaluation.

The standard EV kit comes with the MAX20458ATIA/VY+ installed (3.3V/ADJ, 2.1MHz) but can also be used to evaluate other MAX20458 variants with minimal component changes discussed in the Evaluating Other Variants section.

**Table 1. Default Jumper Settings**

JUMPER	SHUNT POSITION	FUNCTION
JU3_EN1	PIN1-2	Buck1 controller enabled
JU1_EN2	PIN1-2	Boost controller enabled
JU4_FSYNC	PIN1-2	FSYNC is pulled to V <sub>BIAS</sub> enabling FPWM mode
JU_PGOOD1	Installed	PGOOD1 is pulled up to V <sub>BIAS</sub> when OUT1 is in regulation
JU5_EXTVCC	PIN2-3	EXTVCC is connected to GND

### Features

- High-Voltage Step-Down Converter with Integrated Power FETs to Minimize Board-Area-Occupancy
- Asynchronous Boost Controller
- 3.5V to 40V Input Supply Range
- Input Supply Range Extended down to 2V with Pre-Boost Enabled
- 10V Fixed Boost Output Voltage (Separate Option Provides Adjustable Output Voltage)
- Buck Provides 5V/3.3V Output up to 3.5A Output Current
- Buck Output Voltages Adjustable between 1V and 10V using External Resistors
- $\pm 2\%$  Buck Output Voltage Accuracy
- Frequency-Synchronization Input
- Independent Enable Inputs
- Voltage-Monitoring PGOOD1 Output
- Jumpers and Test Points on Key Nodes for Simplified Evaluation
- Proven PCB Layout
- Fully Assembled and Tested

Ordering Information appears at end of data sheet.

## Quick Start

### Required Equipment

- MAX20458 EV kit
- Adjustable DC power supply (PS1)
- One digital multimeter (DMM1)
- One electronic load (EL)

### Procedure

The EV kit is fully assembled and tested. Follow the steps below to verify board operation:

- 1) Verify that all jumpers are in their default positions as shown in [Table 1](#).
- 2) Connect the positive and negative terminals of PS1 to the V<sub>BATT</sub> and GND test pads, respectively.
- 3) Connect the positive terminal of DMM1 to V<sub>OUT1</sub>; connect the negative terminal of DMM1 to PGND1.
- 4) Connect the positive terminal of EL to V<sub>OUT1</sub>; connect the negative terminal of EL to PGND1.
- 5) Set the power supply to 14V and 3A limit.
- 6) The DMM1 voltmeter should display an output voltage of 3.3V when connected to V<sub>OUT1</sub>.

## Detailed Description

The MAX20458 EV kit provides a fully developed and proven layout for evaluating all variants of the MAX20458 family. The IC accepts input supply voltages as high as 36V and input supply transients up to 40V.

### Switching Frequency and External Synchronization

The IC can operate in two modes: forced-PWM or skip mode. Skip mode offers improved efficiency over PWM during light-load conditions. When FSYNC is pulled low, the device operates in skip mode for light loads, and in PWM mode for larger loads. When FSYNC is pulled high, the device is forced to operate in PWM across all load conditions. The EV kit default configuration uses a shunt on JU4\_FSYNC to hold FSYNC high, resulting in forced-PWM mode operation.

The FSYNC pin can be used to synchronize the switching frequency of the IC to an external source by applying an external clock signal. The device is forced to operate in PWM when FSYNC is connected to a clock source.

### Buck Output Monitoring (PGOOD1)

The EV kit provides output test points (PGOOD1) to monitor the status of the buck output voltage on V<sub>OUT1</sub>. PGOOD1 is high impedance when the output voltage is in regulation. PGOOD1 is low impedance when the output voltage drops below 93.5% (typ) of its nominal regulated voltage.

To obtain logic signal, pull up PGOOD1 to V<sub>BIAS</sub> by installing the shunt on jumper JU\_PGOOD1.

### Setting the Output Voltage in Buck Converter

The EV Kit comes pre-assembled to provide a fixed 3.3V voltage regulation on V<sub>OUT1</sub>. To externally adjust the voltage at V<sub>OUT1</sub>, remove R1 and place appropriate resistors in positions R3 and R4 according to the following equation:

$$R3 = R4 \left[ \left( \frac{V_{OUT1}}{V_{FB1}} \right) - 1 \right]$$

where V<sub>FB1</sub> = 1V (typ) and R4 = 50kΩ.

### Selecting EXTVCC

The MAX20458 IC provides an internal low-dropout linear regulator (LDO) that supplies voltage available on the BIAS pin. This LDO can be bypassed when a voltage source is detected at the EXTVCC pin. The EV kit provides jumper JU5\_EXTVCC, which allows shunts to be installed connecting EXTVCC to either V<sub>OUT1</sub> or ground. Bypassing the internal LDO and using the switching converter output to supply V<sub>CC</sub> increases efficiency over enabling the LDO. As assembled, the default position for the JU5\_EXTVCC shunt connects EXTVCC to ground, forcing the internal LDO to supply V<sub>CC</sub> at the BIAS pin.

When the voltage source on EXTVCC drops below the detection level, the internal LDO is enabled to supply V<sub>CC</sub> and BIAS.

### Setting Boost Output Voltage

The EV kit comes installed with the MAX20458ATIA/VY+, which provides an adjustable 10V output voltage. To program  $V_{OUT2}$  voltage, place appropriate resistors in positions R17 and R18 according to the following equation:

$$R17 = R18(V_{OUT2}/V_{FB2} - 1.005)$$

where  $V_{FB2} = 1V$  (typ) and  $R18 = 100k\Omega$ .

### Ordering Information

PART	TYPE
MAX20458EVKIT#	3.3VADJ/2.1MHz EV Kit

# Denotes RoHS Compliant

### Evaluating Other Variants

The EV kit comes installed with the 3.3V/2.1MHz variant (MAX20458ATIA/VY+). The other variants can be installed with minimal component changes. To use the 400kHz devices with the EV kit, change inductor L1 to 10 $\mu$ H, increase L3 to 2.2 $\mu$ H, and increase capacitors C7 and C8 to 47 $\mu$ F. Contact Maxim Integrated for more information on ordering additional variants of MAX20458.

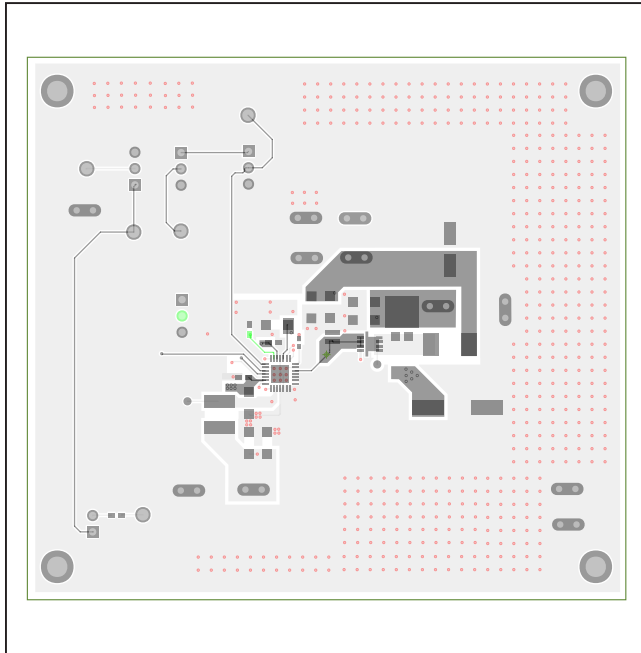
## MAX20458 EV Kit Bill of Materials

ITEM	QTY	MFG PART #	REF DES	DESCRIPTION
1	1	TDK CGA3E2X7R1H104K080AE	C2	0.1UF; 50V; TOL=10%; CAPACITOR; SMT (0603); CERAMIC CHIP;
2	2	Murata GRM31CR71A226KE15;	C7, C8	22UF; 10V; TOL=10%; CAPACITOR; SMT (1206); CERAMIC CHIP;
3	1	TDK CGA2B3X7R1H104K050BB;	C11	0.1UF; 50V; TOL=10%; CAPACITOR; SMT (0402); CERAMIC CHIP;
4	1	TDK CGA3E1X7R0J225K080AC	C13	2.2UF; 6.3V; TOL=10%; CAPACITOR; SMT (0603); CERAMIC;
5	1	Murata GRM188Z71C475KE21	C15	4.7UF ; 16V; TOL=10%; CAPACITOR; SMT (0603); CERAMIC CHIP;
6	8	TDK CGA5L3X7R1H475K160AB	C1, C3, C5, C6, C16, C23, C17, C19	4.7UF ; 50V; TOL=10%; CAPACITOR; SMT (1206); CERAMIC CHIP;
7	1	Murata GCM1885C2A220JA16	C18	22PF; 100V; TOL=5%; CAPACITOR; SMT (0603); CERAMIC CHIP;
8	1	TDK CGA3E1C0G2A472J080AC	C20	4700PF; 100V; TOL=5%; CAPACITOR; SMT (0603); CERAMIC CHIP;
9	1	Panasonic EEE-FT1H470AP	C21	47UF; 50V; TOL=20%;CAPACITOR; SMT (CASE_D); ALUMINUM-ELECTROLYTIC;
10	1	Panasonic EEH-ZC1H101V	C25	100UF; 20%; 50V;CAPACITOR; SMT (CASE_G); ALUMINUM-ELECTROLYTIC
11	1	Vishay V12PM12-M3	D3	EVKIT PART - DIODE; SCH; TO-277A; PIV=120V; IF=12A;
14	1	Coilcraft XAL5030-222ME	L1	2.2UH; 20%; 9.70A;INDUCTOR; SMT; COMPOSITE;
15	1	Vishay IHLP2525CZERR47M01	L3	0.47UH; TOL=+/-20%; 17.5A INDUCTOR; SMT; SHIELDED;
16	1	Würth 742792141	L4	INDUCTOR; SMT (1206); FERRITE-BEAD; 1000; TOL=+/-25%; 1A
12	4	Samtech TSW-103-07-T-S	JU1_EN2, JU3_EN1, JU4_FSYN, JU5_EXTVCC	CONNECTOR; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 3PINS
13	1	Samtech TSW-102-07-T-S	JU_PG00D1	CONNECTOR; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 2PINS;
17	1	Vishay SIS862DN-T1-GE3	Q1	N-CHANNEL MOSFET 60V (D-S) MOSFET; NCH; POWERPAK1212-8; PD-(52W); I-(40A); V-(60V)
18	5	Vishay CRCW06030000Z0	R1, R2, R20, R3, R4	0 OHM; 0%; RESISTOR; 0603; ; JUMPER; 0.1W; THICK FILM
19	1	Vishay CRCW04020000Z0EDHP	R9	0 OHM; 0%; RESISTOR; 0402; JUMPER; 0.2W; THICK FILM
20	1	Susumu KRL2012E-M-R007-F	R11	0.007 OHM; 1%; 50PPM RESISTOR; 0508; ; 1W; METAL FOIL
21	2	Vishay CRCW060351K1FK; Panasonic ERJ-3EKF5112	R5, R7	0603;51.1K;1%;100PPM RESISTOR; 0.10W;THICKFILM
22	1	Vishay CRCW0603909KFKEA	R17	909k OHMS ±1% 0.1W, 1/10W CHIP RESISTOR 0603 THICK FILM
23	1	Vishay CRCW0603100KFKEA	R18	100k OHMS ±1% 0.1W, 1/10W CHIP RESISTOR 0603 THICK FILM
24	5	Keystone 5010	TP_BIAS, TP_EN1, TP_EN2, TP_FSYN, TP_PG00D1	TESTPOINT WITH 1.80MM HOLE DIA, RED, MULTIPURPOSE;
25	1	MAXIM MAX20458ATIA/VY+	U1	EVKIT PART-IC; MAX20458; QFN28-EP; PACKAGE OUTLINE DRAWING: 21-100130; PACKAGE LAND PATTERN: 90-0027
26	1	MAXIM MAX20458EVKIT#	PCB	PCB:MAX20458EVKIT#

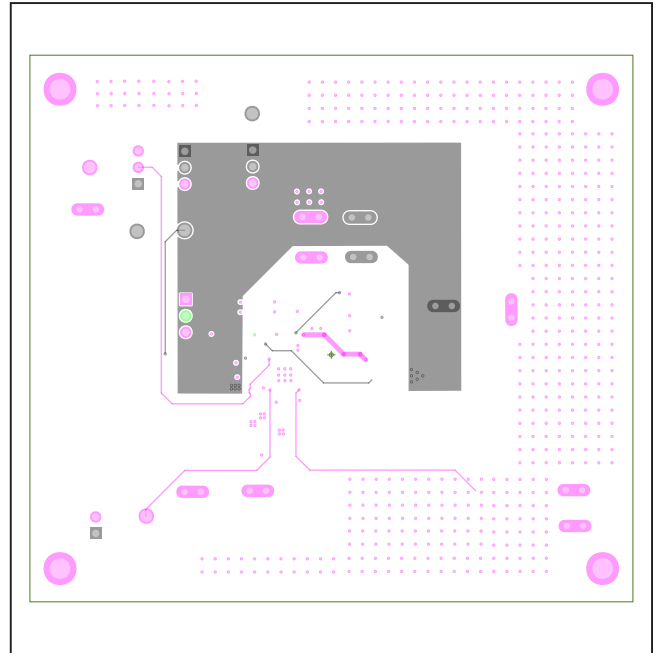
The schematic diagram illustrates a circuit centered around the MAX2448 IC (U1). Key components and connections include:

- MAX2448 (U1):** The central IC with pins connected to various components. Notable pins include LX1, PGND1, PGND, EP, CSP, POND2, POND, and FB2.
- Power and Grounding:** Multiple ground connections (PGND1, PGND, GND1, GND2, GND3, GND4) and power supply points (VOUT1, VOUT2, OUT1, OUT2, CSP).
- Resistors:** R1 (51K), R2, R3, R4, R5, R7 (51K), R8 (4700F), R9, R11 (0.005), R17 (909K), R18 (100K), and R20.
- Capacitors:** C1 (4.7UF), C2 (0.1UF), C3 (4.7UF), C4 (4.7UF), C5 (4.7UF), C6 (4.7UF), C7 (22UF), C8 (22UF), C9 (22UF), C10 (4.7UF), C11 (0.1UF), C12 (4.7UF), C13 (2.2UF), C14 (4.7UF), C15 (4.7UF), C16 (4.7UF), C17 (47UF), C18 (OPEN), C19 (OPEN), C20 (4700F), C21 (47UF), C22 (4.7UF), C23 (4.7UF), C24 (4.7UF), C25 (100UF).
- Transistors:** Q1 (SIS862DN-T1-GE3) and Q2 (VIZPM12A0).
- Other Components:** J1 (J1\_FSYNC), J2 (J2\_FSYNC), J3 (J3\_FSYNC), J4 (J4\_FSYNC), J5 (J5\_EXTVCC), J6 (J6\_FSYNC), J7 (J7\_FSYNC), J8 (J8\_FSYNC), J9 (J9\_FSYNC), J10 (J10\_FSYNC), J11 (J11\_FSYNC), J12 (J12\_FSYNC), J13 (J13\_FSYNC), J14 (J14\_FSYNC), J15 (J15\_FSYNC), J16 (J16\_FSYNC), J17 (J17\_FSYNC), J18 (J18\_FSYNC), J19 (J19\_FSYNC), J20 (J20\_FSYNC), J21 (J21\_FSYNC), J22 (J22\_FSYNC), J23 (J23\_FSYNC), J24 (J24\_FSYNC), J25 (J25\_FSYNC), J26 (J26\_FSYNC), J27 (J27\_FSYNC), J28 (J28\_FSYNC), J29 (J29\_FSYNC), J30 (J30\_FSYNC), J31 (J31\_FSYNC), J32 (J32\_FSYNC), J33 (J33\_FSYNC), J34 (J34\_FSYNC), J35 (J35\_FSYNC), J36 (J36\_FSYNC), J37 (J37\_FSYNC), J38 (J38\_FSYNC), J39 (J39\_FSYNC), J40 (J40\_FSYNC), J41 (J41\_FSYNC), J42 (J42\_FSYNC), J43 (J43\_FSYNC), J44 (J44\_FSYNC), J45 (J45\_FSYNC), J46 (J46\_FSYNC), J47 (J47\_FSYNC), J48 (J48\_FSYNC), J49 (J49\_FSYNC), J50 (J50\_FSYNC), J51 (J51\_FSYNC), J52 (J52\_FSYNC), J53 (J53\_FSYNC), J54 (J54\_FSYNC), J55 (J55\_FSYNC), J56 (J56\_FSYNC), J57 (J57\_FSYNC), J58 (J58\_FSYNC), J59 (J59\_FSYNC), J60 (J60\_FSYNC), J61 (J61\_FSYNC), J62 (J62\_FSYNC), J63 (J63\_FSYNC), J64 (J64\_FSYNC), J65 (J65\_FSYNC), J66 (J66\_FSYNC), J67 (J67\_FSYNC), J68 (J68\_FSYNC), J69 (J69\_FSYNC), J70 (J70\_FSYNC), J71 (J71\_FSYNC), J72 (J72\_FSYNC), J73 (J73\_FSYNC), J74 (J74\_FSYNC), J75 (J75\_FSYNC), J76 (J76\_FSYNC), J77 (J77\_FSYNC), J78 (J78\_FSYNC), J79 (J79\_FSYNC), J80 (J80\_FSYNC), J81 (J81\_FSYNC), J82 (J82\_FSYNC), J83 (J83\_FSYNC), J84 (J84\_FSYNC), J85 (J85\_FSYNC), J86 (J86\_FSYNC), J87 (J87\_FSYNC), J88 (J88\_FSYNC), J89 (J89\_FSYNC), J90 (J90\_FSYNC), J91 (J91\_FSYNC), J92 (J92\_FSYNC), J93 (J93\_FSYNC), J94 (J94\_FSYNC), J95 (J95\_FSYNC), J96 (J96\_FSYNC), J97 (J97\_FSYNC), J98 (J98\_FSYNC), J99 (J99\_FSYNC), J100 (J100\_FSYNC).

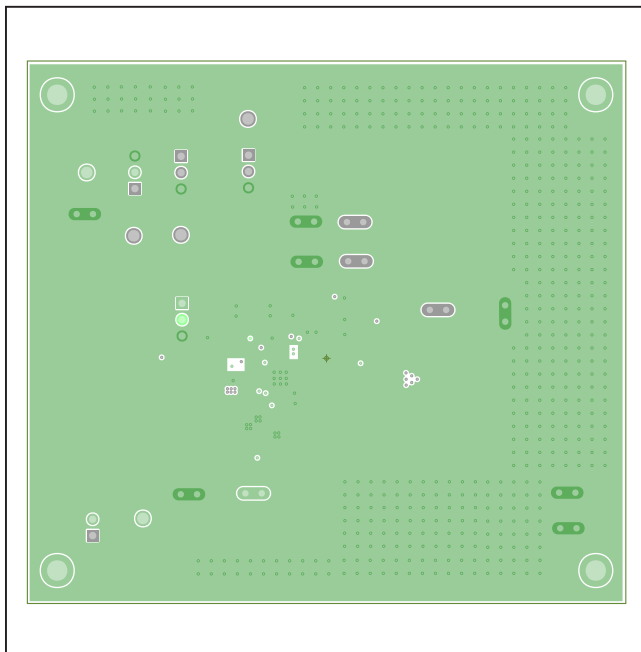
## MAX20458 EV Kit PCB Layout Diagrams



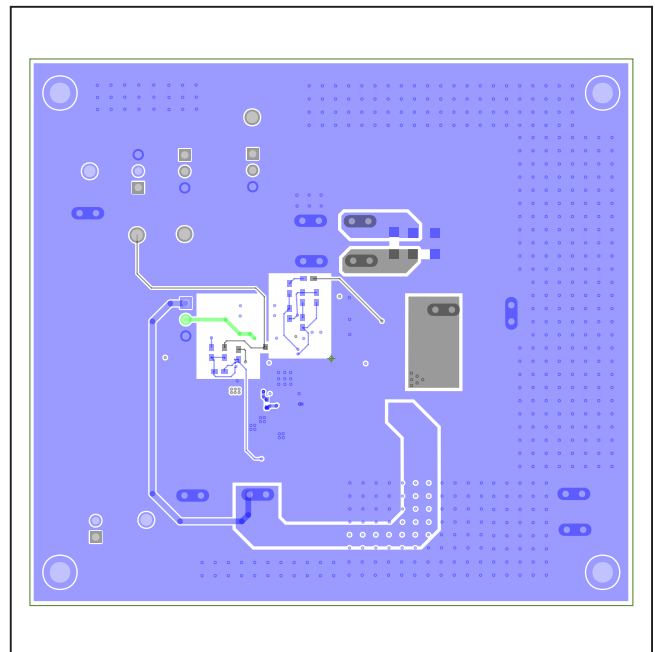
MAX20458 EV Kit Component Placement - Top



MAX20458 EV Kit PCB Layout - Internal Layer 3

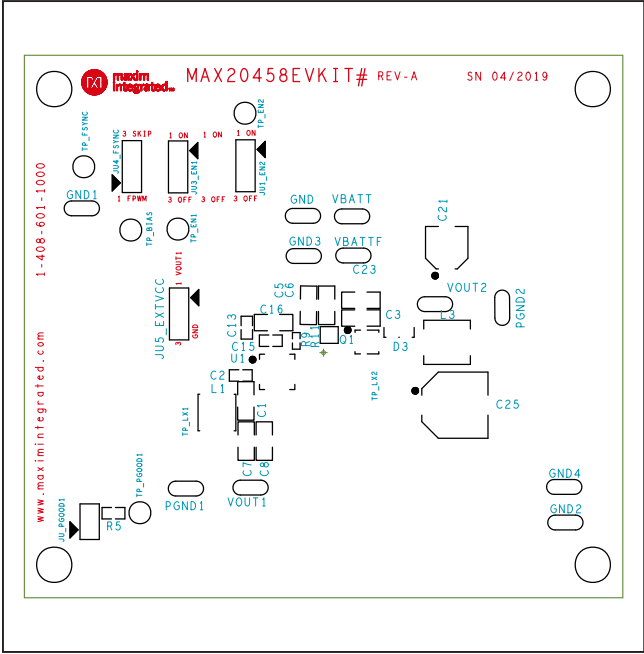


MAX20458 EV Kit PCB Layout - Internal Layer 2

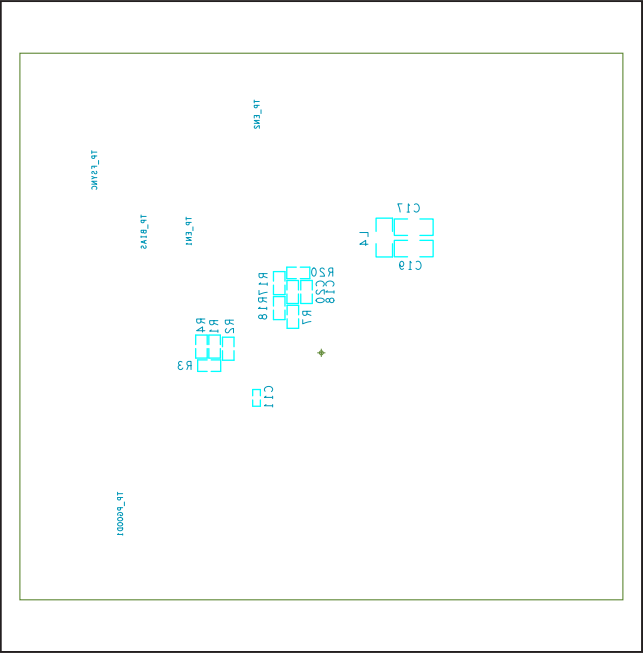


MAX20458 EV Kit Component Placement - Bottom

MAX20458 EV Kit PCB Layout Diagrams (continued)



MAX20458 EV Kit Silkscreen Top



MAX20458 EV Kit Silkscreen Bottom

## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	7/19	Initial release	—
1	7/19	Updated <a href="#">Detailed Description</a>	2, 3

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at <https://www.maximintegrated.com/en/storefront/storefront.html>.

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