HMC881LP5E

v01.0110

FILTER - TUNABLE, LOW PASS SMT 2.2 - 4.0 GHz

Typical Applications

The HMC881LP5E is ideal for:

- Test & Measurement Equipment
- Military RADAR & EW/ECM
- SATCOM & Space
- Industrial & Medical Equipment

Features

Fast Tuning Response; 150 ns

Excellent Wideband Rejection; 40 dB

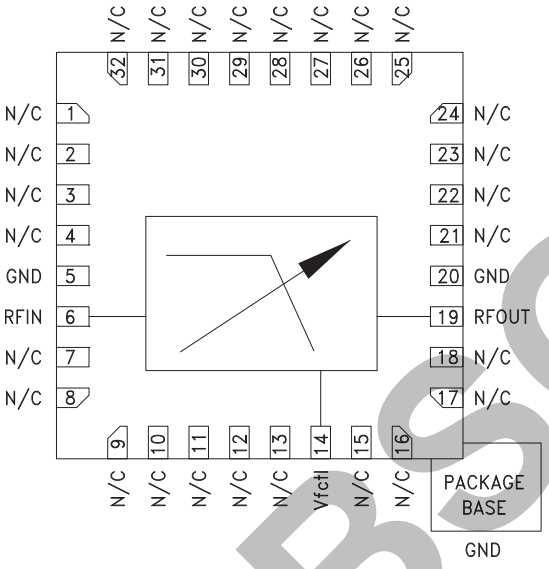
Single Positive Frequency Control: 0 to +14V

Low Insertion Loss &
User Selectable Cutoff Frequency

Single Chip Replacement
for Mechanically Tuned Designs

32 Lead 5x5 mm SMT Package

Functional Diagram



General Description

The HMC881LP5E is a MMIC low pass filter which features a user selectable cutoff frequency. The cutoff frequency can be varied from 2.2 to 4.0 GHz by applying a single analog tuning voltage between 0 and 14V. This low pass filter provides a low 3.8 dB insertion loss, 10 dB return loss and 1.25 x ƒcutoff stopband attenuation of >20 dB. This tunable filter can be used as a much smaller alternative to physically large switched filter banks and cavity tuned filters. The HMC881LP5E has excellent microphonics due to the monolithic design, and provides a dynamically adjustable solution in advanced communications applications. The low pass tunable filter is packaged in a RoHS compliant 5x5mm QFN leadless package.

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Electrical Specifications, T_A = +25°C

Parameter	Min.	Typ.	Max.	Units
Passband	0		4	GHz
ƒcutoff [1] Tuning Range	2.2		4	GHz
Stopband Frequency (Rejection >20 dB)		1.25 x ƒcutoff		GHz
Re-entry Frequency (Rejection <30 dB)		30		GHz
Insertion Loss		3.8		dB
Return Loss		10		dB
Maximum Input Power for Linear Operation			10	dBm
Frequency Control Voltage (Vfctl)	0		14	V
Frequency Control Port Source/Sink Current (I_{fctl})			±1	mA
Residual Phase Noise [2] (1 MHz offset)		-165		dBc/Hz
ƒcutoff Drift Rate (Fixed Vfctl)		-0.8		MHz/°C
Tuning Characteristics [3] tFULLBAND (0% Vfctl to 90% RF)		150		ns

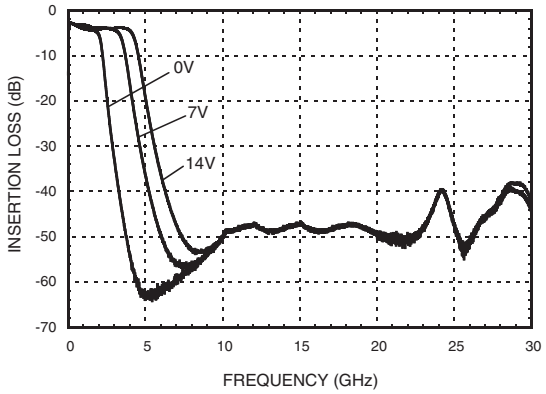
[1] ƒcutoff defined as the point at which the insertion loss is 3 dB below the minimum passband insertion loss.
[2] Optimum residual phase noise performance requires the use of a low noise driver circuit.
[3]Tuning speed is dependent on driver circuit. Data measured with a high speed op-amp driver and includes driver slew rate delay.

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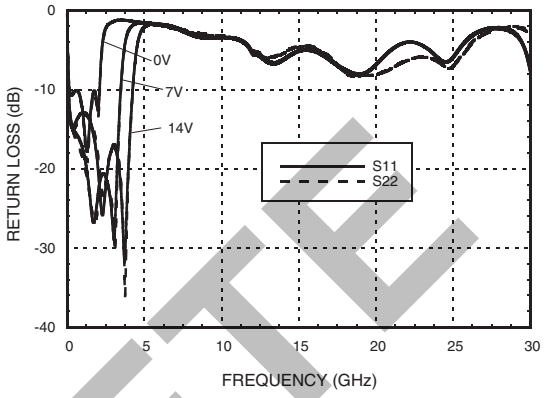
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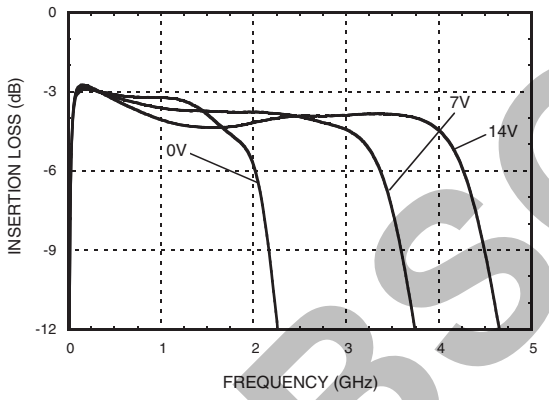
Broadband Insertion Loss vs. Control Voltage



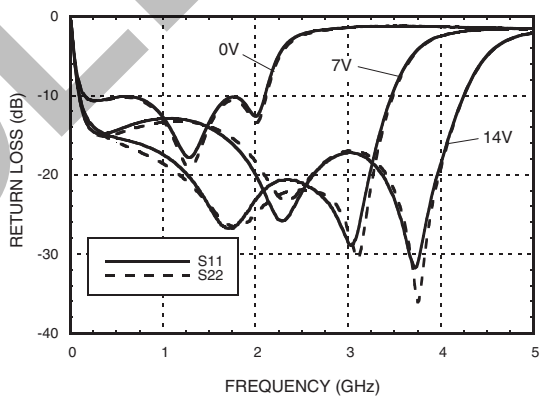
Broadband Return Loss vs. Control Voltage



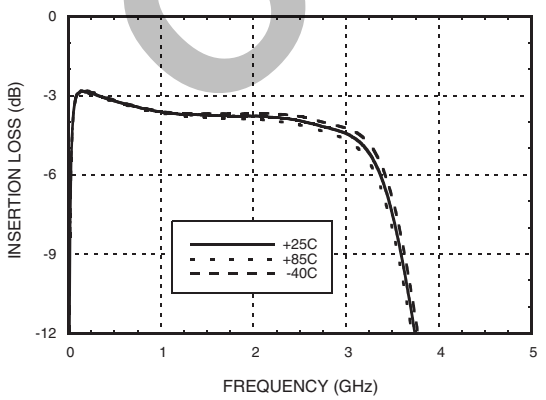
Insertion Loss vs. Control Voltage [1]



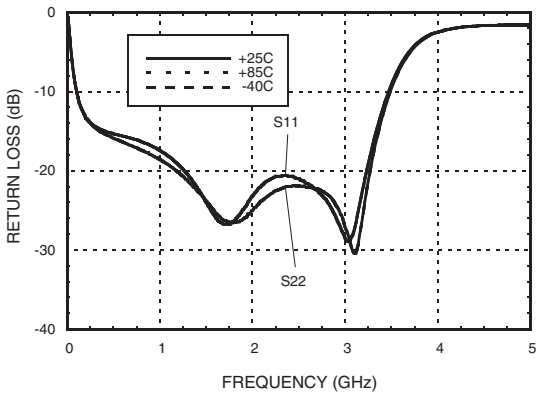
Return Loss vs. Control Voltage [1]



Insertion Loss vs. Temperature, Vfctl @ 7V [1]



Return Loss vs. Temperature, Vfctl @ 7V [1]



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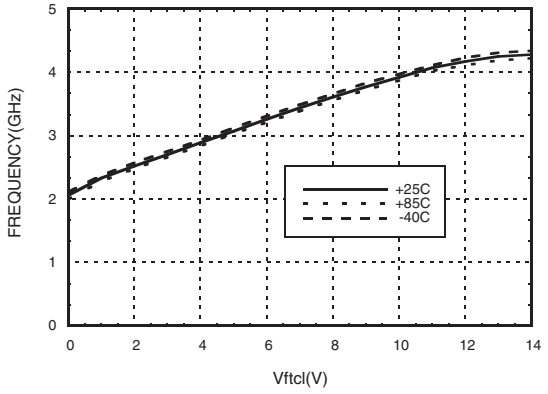
[1] Low frequency performance limited by external DC blocking capacitors at RF input and output.

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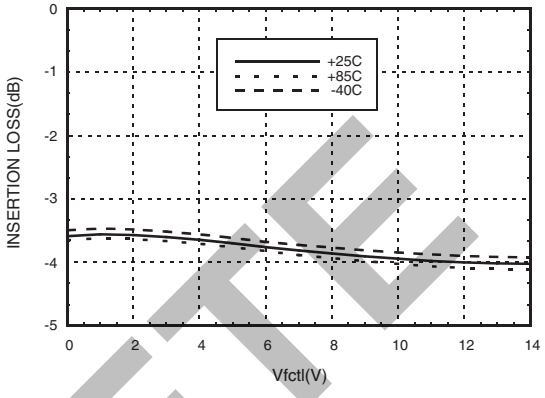
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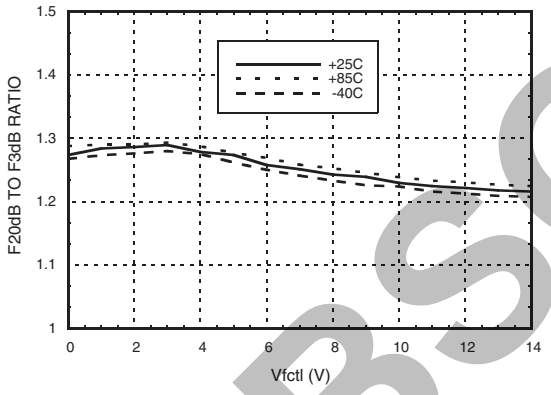
Cutoff Frequency vs. Temperature



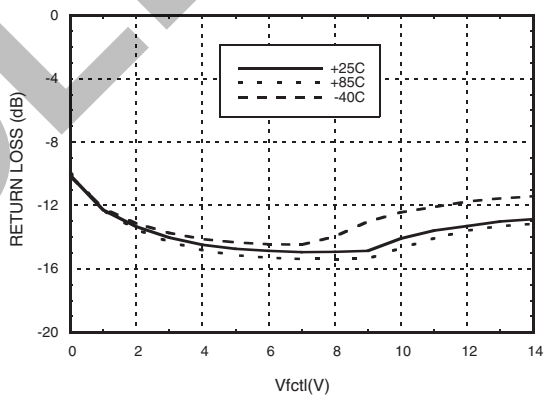
Average Insertion Loss vs. Temperature in a 2 dB Bandwidth



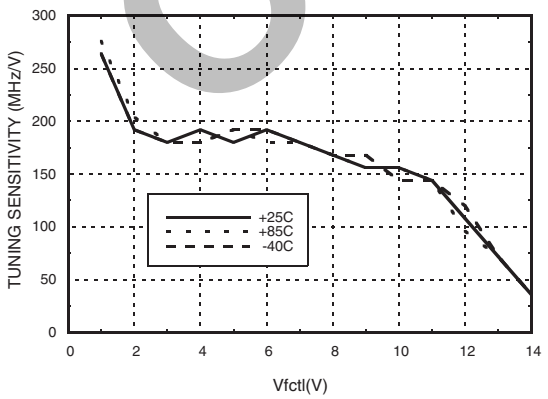
Rejection Ratio vs. Temperature [1]



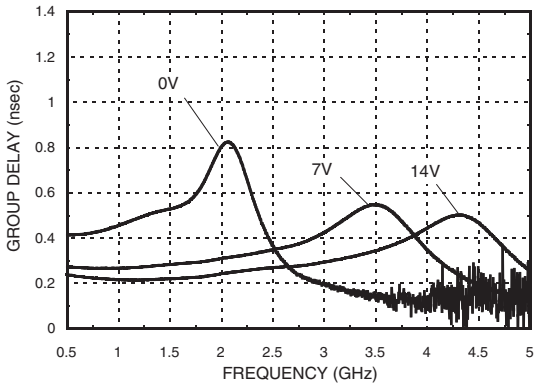
Maximum Return Loss in a 2 dB Bandwidth vs. Temperature



Tuning Sensitivity vs. Temperature



Group Delay



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[1] Rejection ratio is defined as the ratio of the frequency at which the relative insertion loss is 20 dB, to $f$cutoff

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Absolute Maximum Ratings

Frequency Control Voltage (Vfctl)	-0.5 to +15V
RF Power Input	26.5 dBm
Storage Temperature	-65 to +150 °C
ESD Rating (HBM)	Class 1B

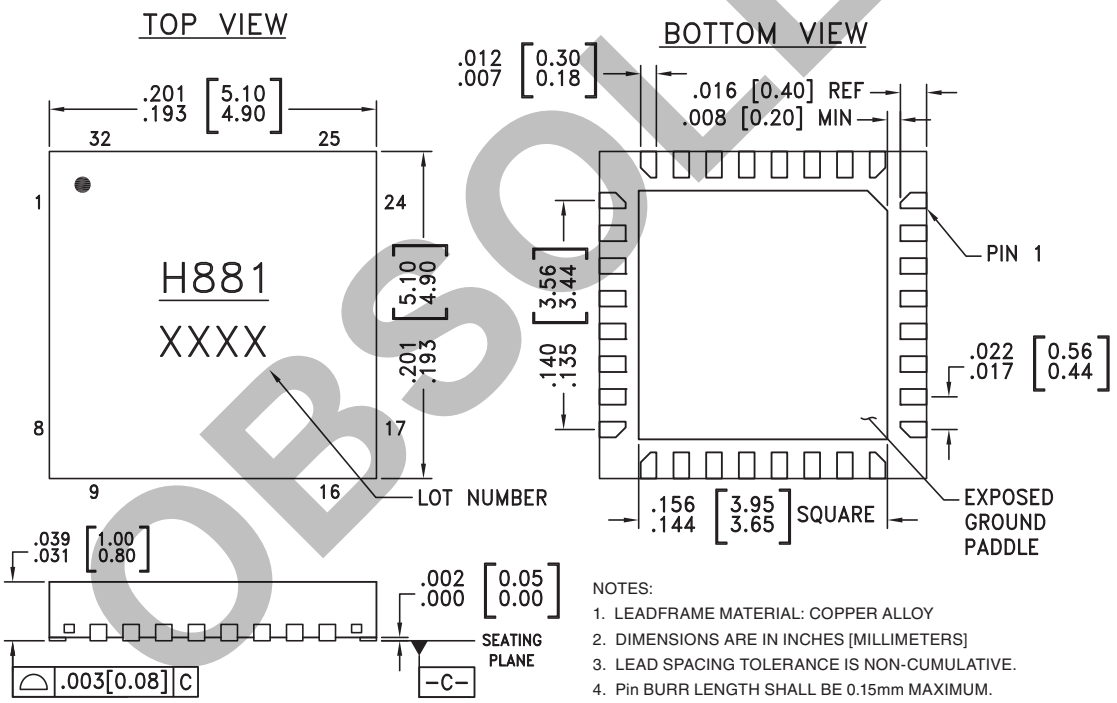
Reliability Information

Junction Temperature to Maintain 1 Million Hour MTTF	150 °C
Nominal Junction Temperature (T= 85 °C and Pin = 10 dBm)	90 °C
Operating Temperature	-40 to +85 °C

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

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Outline Drawing



NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
4. Pin BURR LENGTH SHALL BE 0.15mm MAXIMUM. Pin BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [1]
HMC881LP5E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H881 XXXX

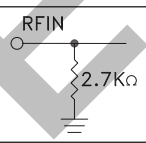
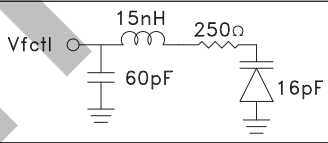
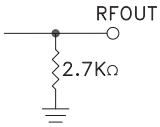
[1] 4-Digit lot number XXXX
[2] Max peak reflow temperature of 260 °C

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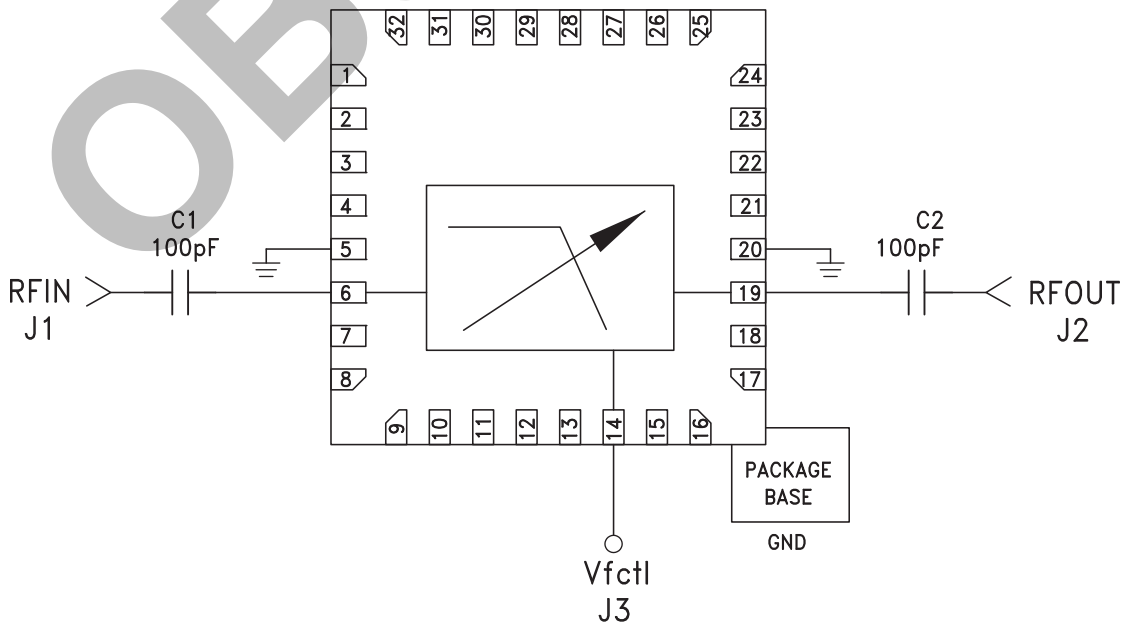
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Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1 - 4, 7 - 13, 15 - 18, 21 - 32	N/C	The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally.	
5, 20	GND	These pins and exposed paddle must be connected to RF/DC ground.	
6	RFIN	This pin is DC coupled and matched to 50 Ohms. External voltage must not be applied to this pin.	
14	Vfctl	Cutoff frequency control voltage.	
19	RFOUT	This pin is DC coupled and matched to 50 Ohms. External voltage must not be applied to this pin.	

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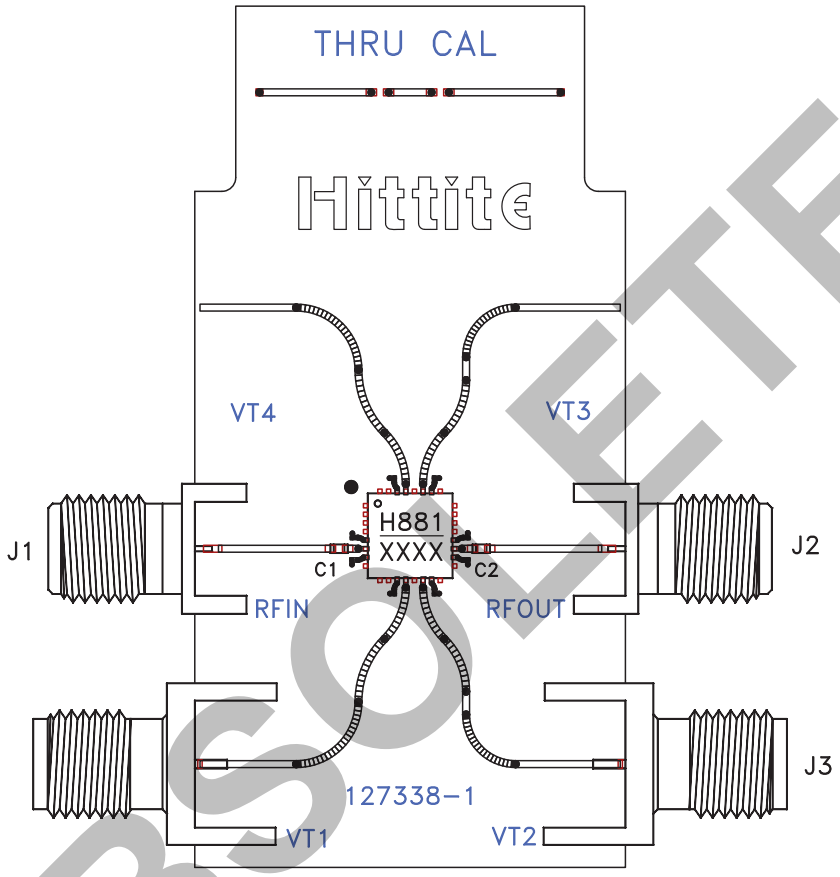
Application Circuit



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Evaluation PCB



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List of Materials for Evaluation PCB 128531 [1]

Item	Description
J1 - J3	SMA - SRI
C1, C2	100 pF Capacitor, 0402 Pkg.
U1	HMC881LP5E Filter
PCB [2]	127338 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25FR or Rogers 25FR

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohms impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board shown is available from Hittite upon request.

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