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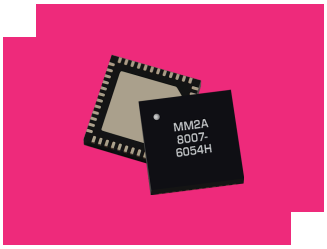
MM2A-0530HPSM

Integrated Drive GaAs MMIC Mixer

DEVICE OVERVIEW

General Description

The MM2A-0530HPSM is a versatile, robust, and broadband triple balanced mixer with an integrated broadband LO driver amplifier. The MM2A-0530HPSM is ideal for applications with wide and overlapping bandwidths and operation through the K band. The integrated LO driver amplifier allows for operation with LO powers as low as +0dBm while retaining exceptional conversion loss and linearity.



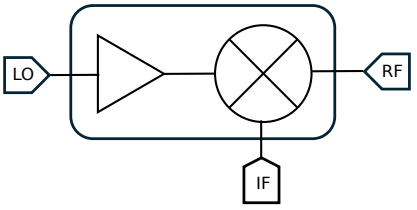
Features

- RF/LO response: 5GHz - 30GHz
- IF response: 2 – 22GHz
- Integrated LO Driver Amplifier
- Minimum LO drive: +0dBm
- Conversion Loss: 8 dB

Applications

- Single Sideband and Image Rejection Mixing
- IQ Modulation / Demodulation
- Vector Amplitude Modulation
- Band Shifting
- 5G Band Support

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
MM2A-0530HPSM	Integrated Drive GaAs MMIC Mixer	QFN	REACH RoHS	Released	EAR99
EVB-MM2A-0530HP	Evaluation Board, Integrated Drive GaAs MMIC Mixer	EVB	RoHS REACH	Released	EAR99

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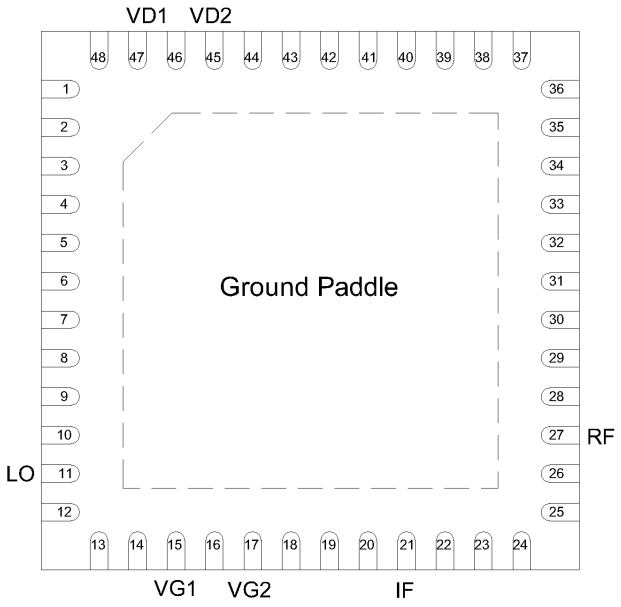
Revision History

Revision Code	Revision Date	Comment
-	2024-05-06	Initial Release
A	2024-11-21	Updated 2D outline drawing per ECN#24129. Corrected number of decimal places in dimensions.
B	2025-08-04	Updated outline drawing per ECN #172-07-21-2025. Corrected RF and IF pin location.

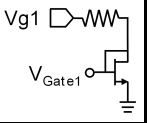
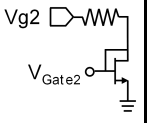
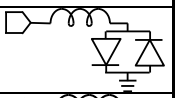
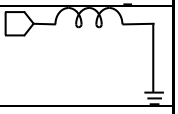
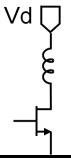
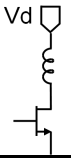
Port Configuration and Functions

Port Diagram

A top-down x-ray view of the MM2A-0530HPSM's PSM package outline drawing is shown below. The MM2A-0530HPSM has the input and output ports given in Port Functions.



Port Functions

Port	Function	Description	DC Equivalent Circuit
Pin 11	LO Input	Pin 11 is DC open and AC matched to 50Ω over the specified LO frequency range.	
Pin 15	Vg1	Pin 15 provides bias for an internal current mirror that sets the current draw for amplifier input stage. Increasing current will increase gain at the expense of efficiency. The default series resistor (270 Ohms) is chosen to optimize gain, output power and efficiency when Vg1 and Vd1 are both tied to 5V.	
Pin 17	Vg2	Pin 17 provides bias for an internal current mirror that sets the current draw for amplifier output stage. Increasing current will increase gain at the expense of efficiency. The default series resistor (82.5 Ohms) is chosen to optimize gain, output power and efficiency when Vg2 and Vd2 are both tied to 5V.	
Pin 21	IF	Pin 21 is diode coupled and AC matched to 50Ω over the specified IF port frequency range.	
Pin 27	RF Input / Output	Pin 27 is DC short and AC matched to 50Ω over the specified RF frequency range.	
Pin 45	Vd2	Pin 45 is the DC supply pin for the amplifier's output stage.	
Pin 47	Vd1	Pin 47 is the DC supply pin for the amplifier's input stage.	

Specifications

Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If any one of these limits are exceeded, the device may become inoperable or have a reduced lifetime. Reliability limits are individual, instantaneous catastrophic limits only. Functional operation limits are indicated below. Operation of the device at multiple absolute maximum limits or for extended periods at a single limit can cause degradation and damage to the device.

Parameter	Maximum Rating	Unit
Bias Current (Ig1+Ig2)	95	mA
Bias Voltage (Vg1,Vg2)	6	V
DC Current (IF)	30	mA
Drain Current (Id1+Id2)	400	mA
Drain Supply Voltage (Vd1,Vd2)	6	V
Maximum Operating Temperature	85	°C
Maximum Storage Temperature	125	°C
Minimum Operating Temperature	-40	°C
Minimum Storage Temperature	-65	°C
Power Handling, at any Port	15	dBm

Package Information

Parameter	Details	Rating
Dimensions	-	7x7 mm
Moisture Sensitivity Level	-	MSL 1

Recommended Operating Conditions

The Recommended Operating Conditions indicate the limits, inside which the device should be operated, to guarantee the performance given in Electrical Specifications Operating outside these limits may not necessarily cause damage to the device, but the performance may degrade outside the limits of the electrical specifications. For limits, above which damage may occur, see Absolute Maximum Ratings.

Parameter	Min	Nominal	Max	Unit
Positive DC Voltage	-	5	-	V
LO Input Power	-3	0	3	-
Power Supply DC Current (Ig) (No RF Input)	11	19	23	mA
Power Supply DC Current (Id) (No RF Input)	121	218	259	mA

Sequencing Requirements

There is no sequencing required to power up or power down the mixer.

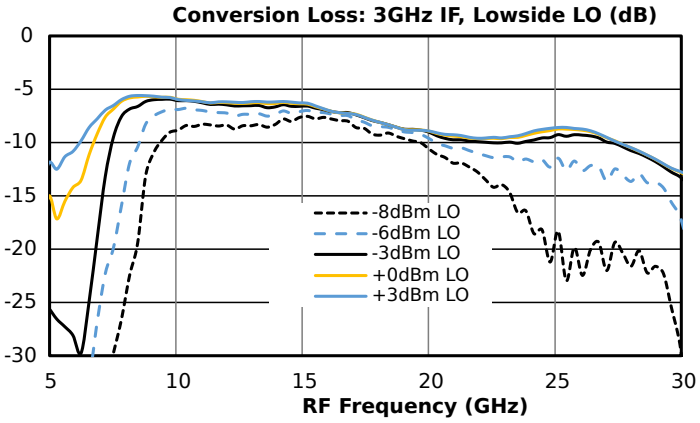
Electrical Specifications

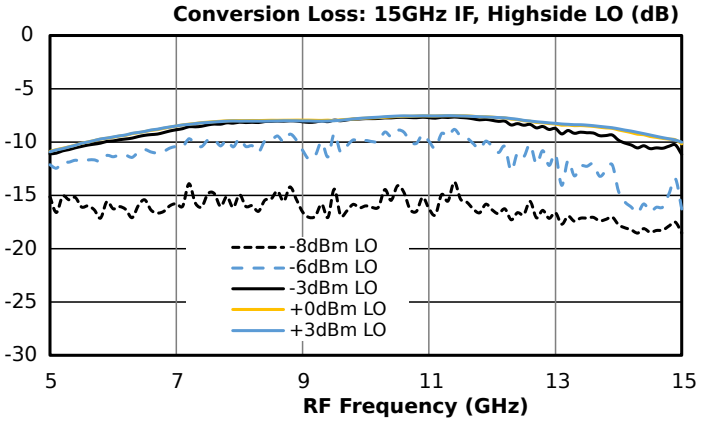
The electrical specifications apply at TA=+25°C in a 50Ω system. Typical data shown is for a down conversion application with a +0dBm LO input to the integrated LO driver amp biased at +5Vd1/+5Vd2/+5Vg1/+5Vg2 unless otherwise specified.

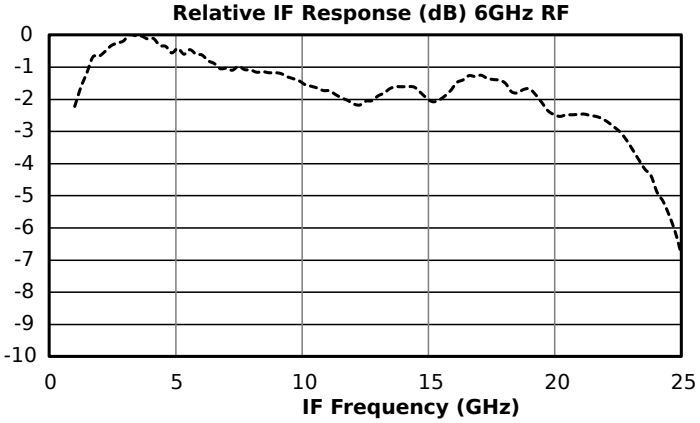
Parameter	Test Conditions	Min	Typ	Max	Unit
Conversion Loss	RF/LO = 5 - 30 GHz I = 2 - 22 GHz	-	8	-	dB
IF Frequency Range	-	2	-	22	GHz
Input IP3	RF/LO = 5 - 30 GHz I = 2 - 22 GHz	-	25	-	dBm
Input P1dB	-	-	15	-	dBm
Isolation, RF to IF	RF/LO = 5 - 30 GHz	-	39	-	dB
LO Frequency Range	-	5	-	30	GHz
LO Leakage, LO to IF	RF/LO = 5 - 30 GHz	-	24	-	dBm
LO Leakage, LO to RF	RF/LO = 5 - 30 GHz	-	23	-	dBm
Noise Figure	RF/LO = 5 - 30 GHz I = 2 - 22 GHz	-	8	-	dB
RF Frequency Range	-	5	-	30	GHz

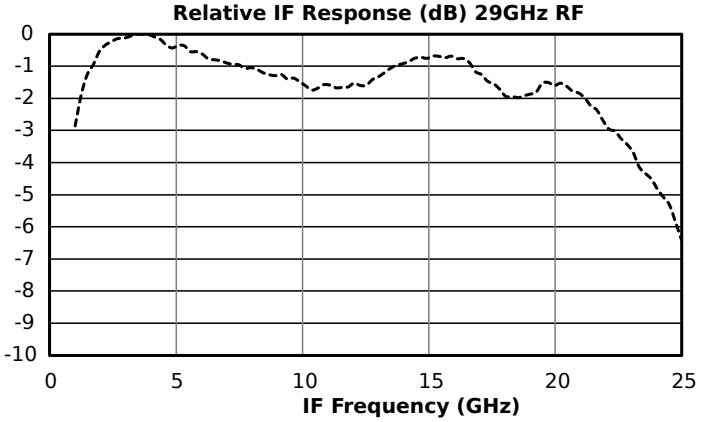
Eval board IF and RF traces were de-embedded using AFR and LO trace power correction was applied to show the true performance of the QFN. Measured as a down converter, unless otherwise stated Mixer Noise Figure typically measures within 0.5 dB of conversion loss for IF frequencies greater than 5 MHz.

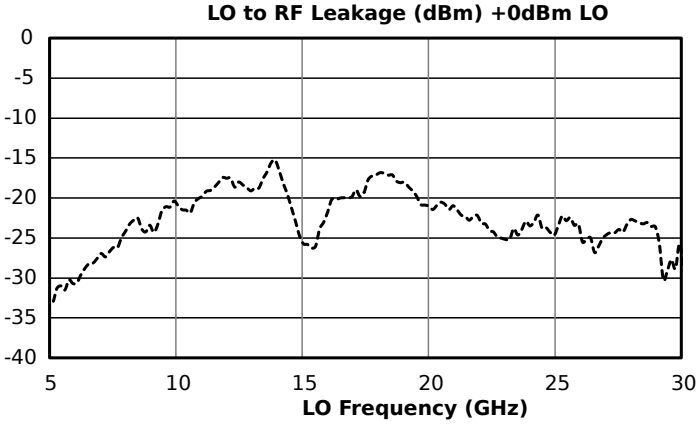
Typical Performance Plots

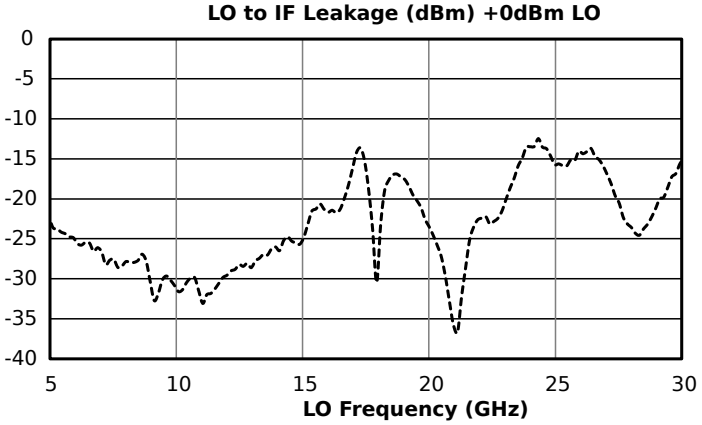


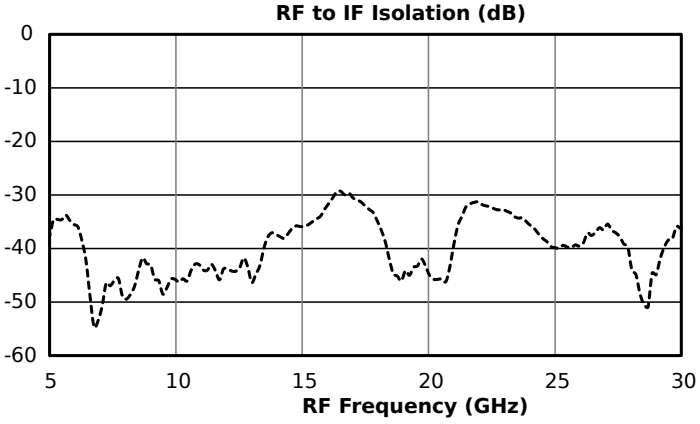


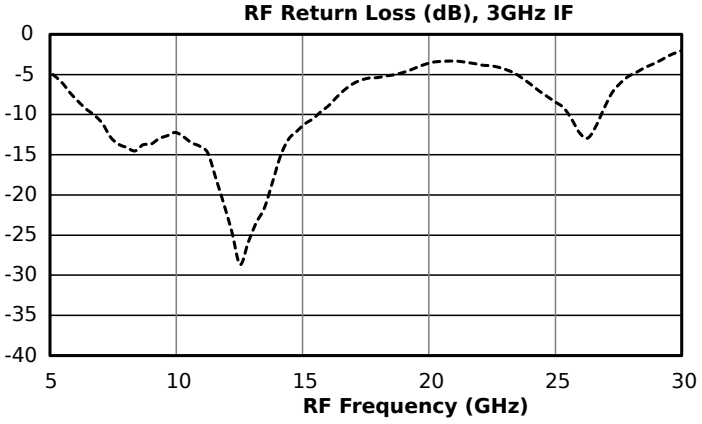


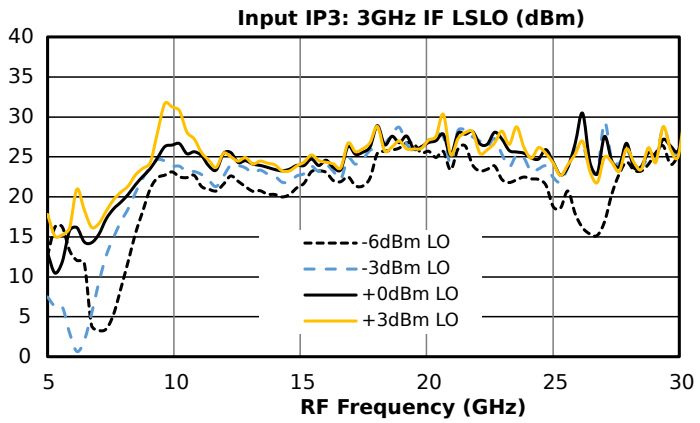


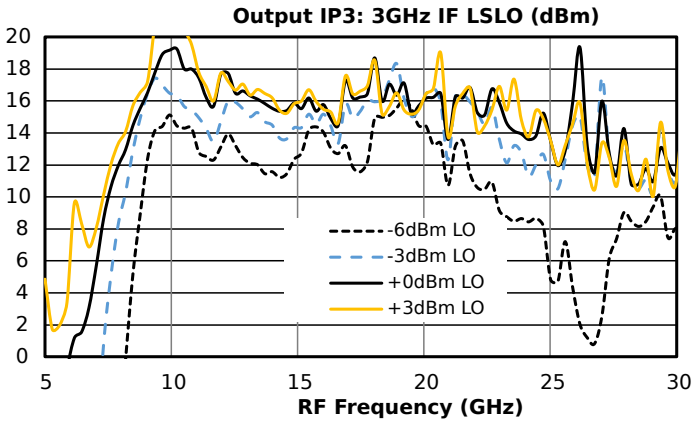


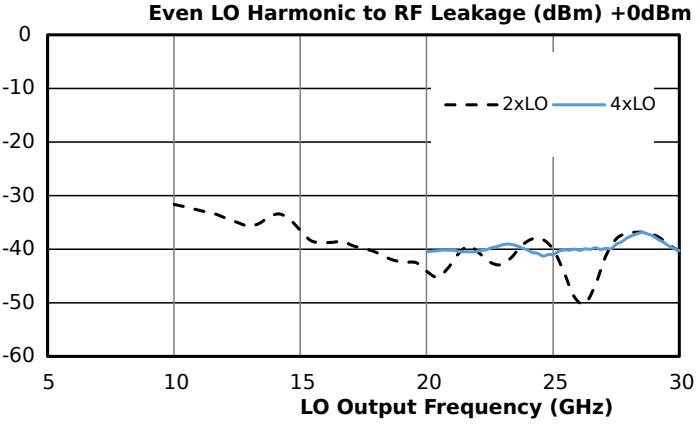


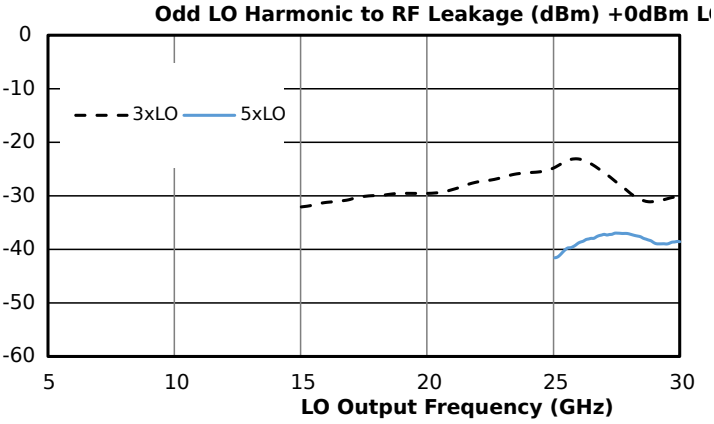


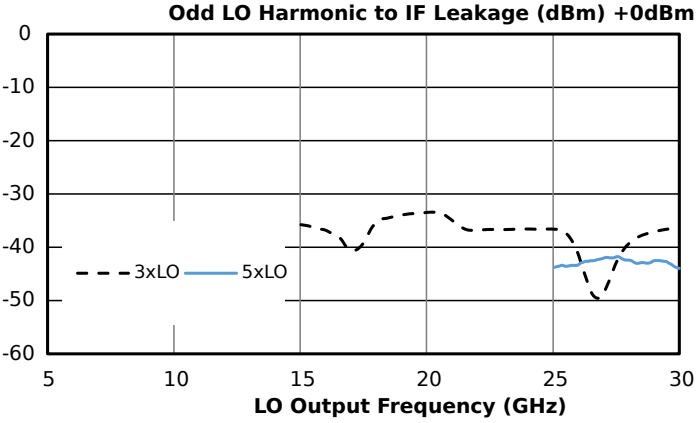


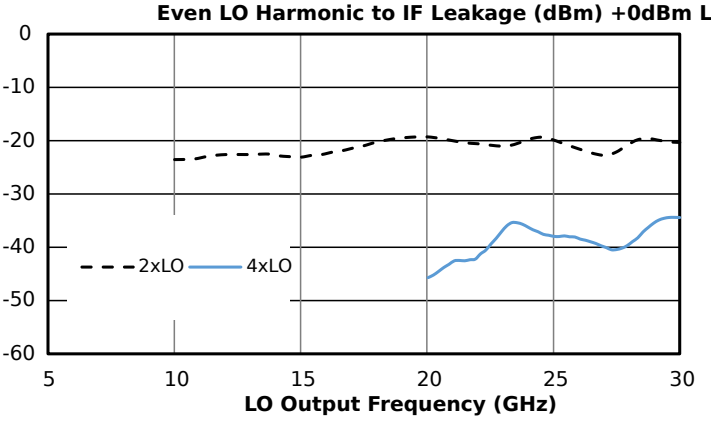


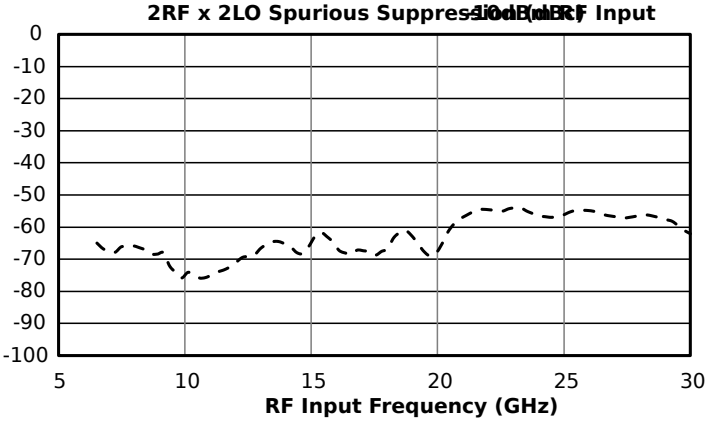


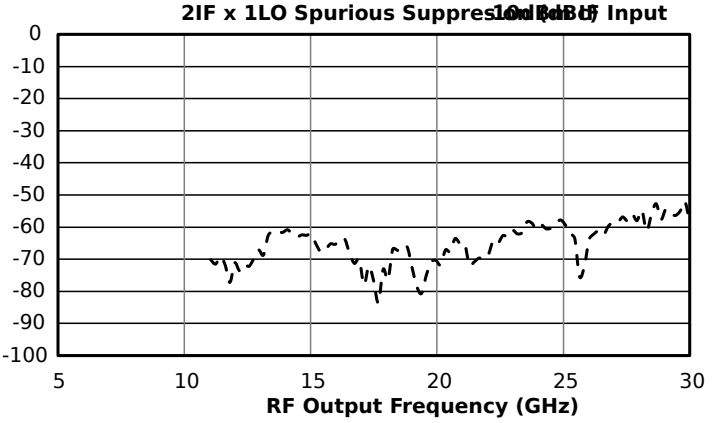


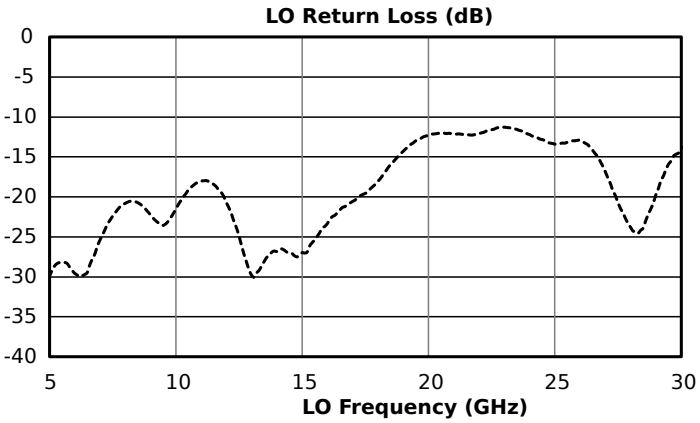


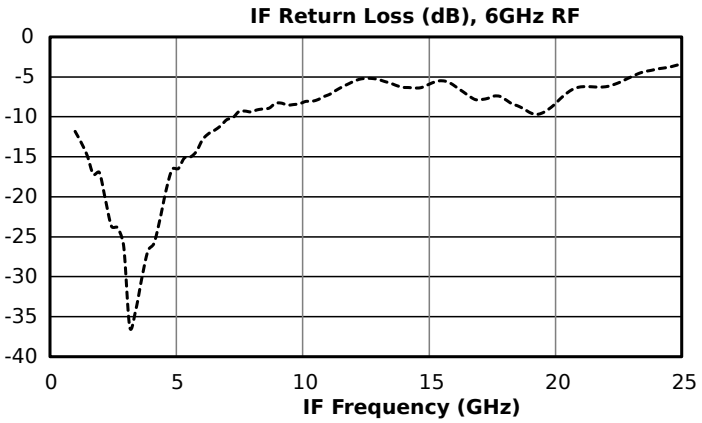


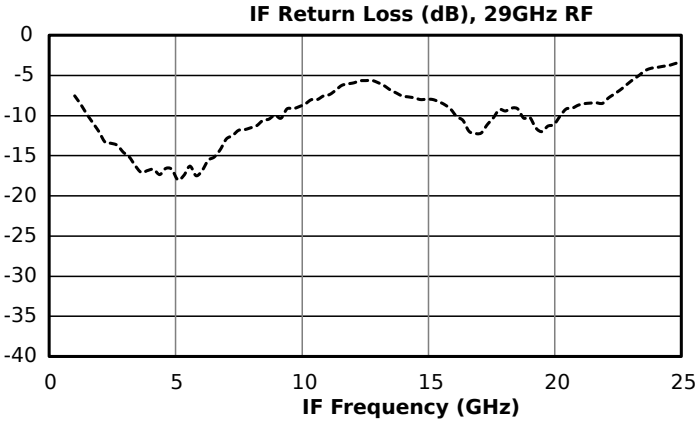












Spur Table

Downconversion Spurious Suppression

Spurious data is taken by selecting RF and LO frequencies (+mLO+nRF) within the 5 to 30 GHz RF/LO bands, which create a 3 GHz IF spurious output. The mixer is swept across the full spurious band and the mean is calculated. The numbers shown in the table below are for a -10 dBm RF input. Spurious suppression is scaled for different RF power levels by (n-1), where "n" is the RF spur order. For example, the 2RFx2LO spur is 65 dBc for a -10 dBm input, so a -20 dBm RF input creates a spur that is (2-1) x (-10 dB) dB lower, or75 dBc.

Typical Downconversion Spurious Suppression (dBc)						
-10 dBm RF Input	**0xLO**	**1xLO**	**2xLO**	**3xLO**	**4xLO**	**5xLO**
1×RF	34	Reference	29	72	81	22
2xRF	63	65	65	69	70	75
3xRF	90	77	94	83	92	83
4xRF	153	118	119	122	124	123
5xRF	180	141	142	141	147	144

Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.

Upconversion Spurious Suppression

Spurious data is taken by mixing a 3 GHz IF with LO frequencies (+mLO+nIF), which creates an RF within the 5 to 30 GHz RF band. The mixer is swept across the full spurious output band and the mean is calculated. The numbers shown in the table below are for a -10 dBm IF input. Spurious suppression is scaled for different IF input power levels by (n-1), where "n" is the IF spur order. For example, the 2IFx1LO spur is typically 62 dBc for a -10 dBm input, so a -20 dBm IF input creates a spur that is (2-1) x (-10 dB) dB lower, or72 dBc.

Typical Upconversion Spurious Suppression (dBc)						
-10 dBm IF Input	**0xLO**	**1xLO**	**2xLO**	**3xLO**	**4xLO**	**5xLO**
1×RF	32	Reference	32	14	34	24
2xRF	71	62	68	65	76	64
3xRF	100	79	86	73	79	71
4xRF	123	111	120	12	121	112
5xRF	138	125	144	136	130	124

Specifications are subject to change without notice. Contact Marki Microwave for the most recent specifications and data sheets.

Application Information

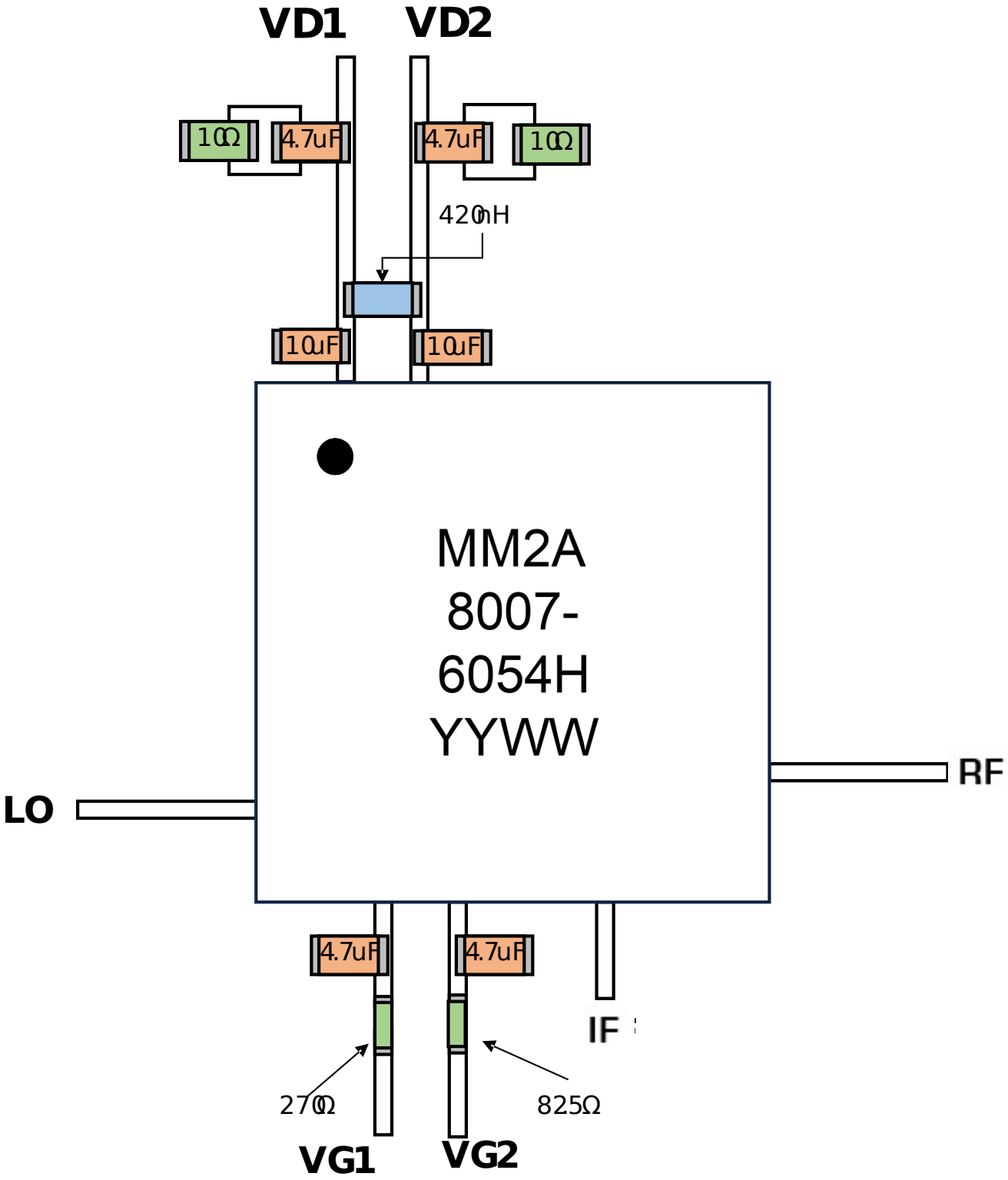
MM2A-0530HPSM belongs to Marki Microwave's MM2 family of mixers with integrated LO drivers. The MM2 product line consists of passive GaAs MMIC mixers designed and fabricated with GaAs Schottky diodes.

Band support for the low frequency 5G frequencies in K and Ka bands is offered by the ultra-broadband performance of the mixer's RF and LO ports (ports 27 and 11). Direct baseband to Ka band frequency conversions are available by using of this mixer as an up-converter.

Pin 27, the RF port, and Pin 11, the LO port, supports a 5-30 GHz signal. Pin 21, the IF port, supports a 2-22 GHz signal. A signal may be input into any port of the mixer which supports that signal's frequency. This is the basis of using the mixer as a band shifter.

For a given LO power within the recommended operating range, the RF (in the case of a down conversion) or IF (in the case of an up conversion) input power should be below the input 1 dB compression point to avoid signal distortion. The input 1 dB compression point will vary across the mixer's operating bandwidth and with LO input power. Careful characterization is required foroptimal performance for each application. There is no minimum small signal input power required for operation. Excessive RF/IF input power increases non-desired spurious output power and degrades the fundamental conversion loss. Excessive LO input power can also cause this effect.

Application Circuit



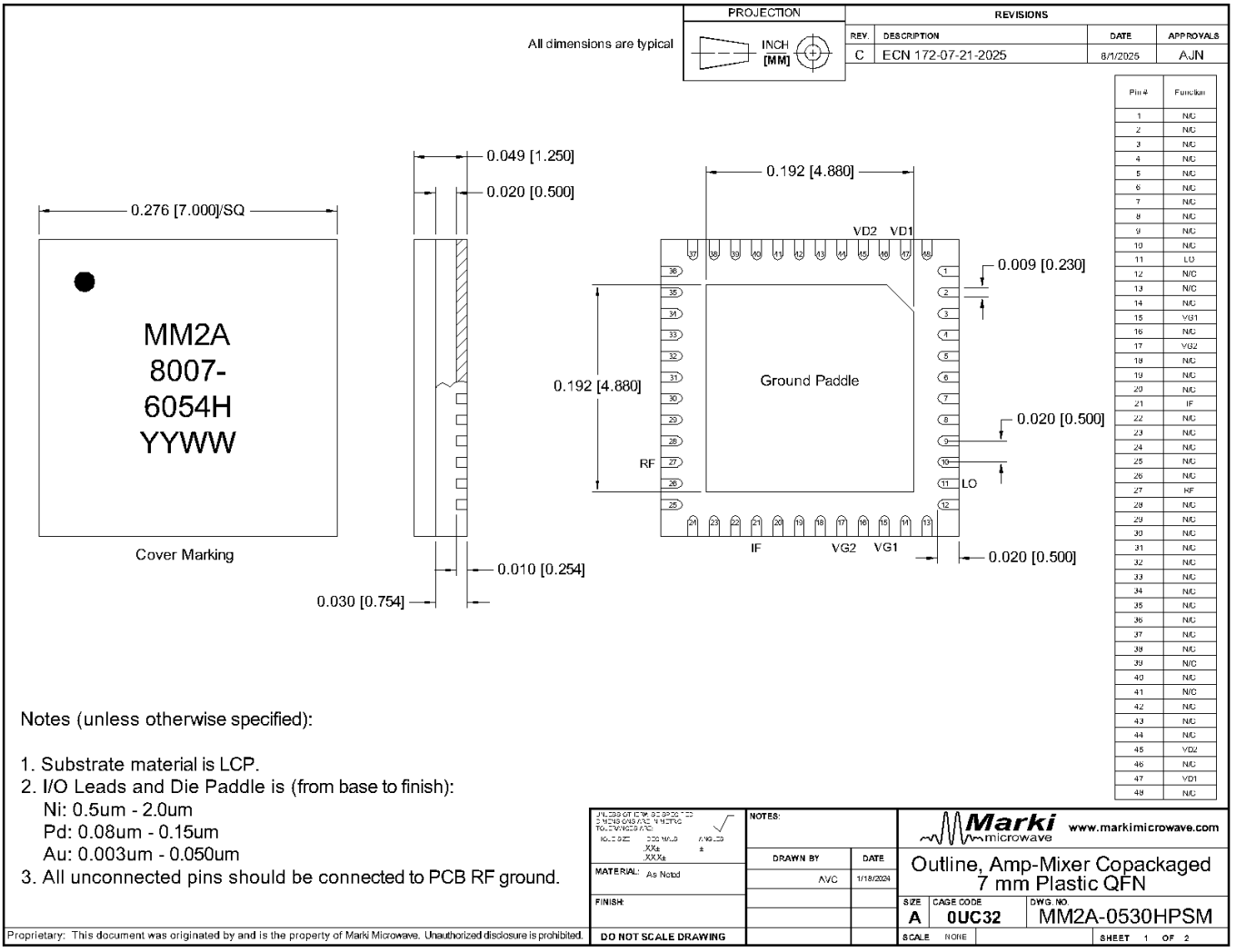
Application Circuit Description

The application circuit for the MM2A-0530HPSM requires 10uF bypass capacitors on the drain lines near the QFN. A 420nH inductor is needed between the VD lines to provide isolation as well as an RC network to ground comprised of a 4.7uF capacitor and 10Ω resistor. The VG lines require 4.7uF bypass capacitors and series resistors of 270Ω in line with the VG supply. The current evaluation circuit is configured for single supply operation, but can be operated as dual supply by removing the 420nH inductor.

Mechanical Data

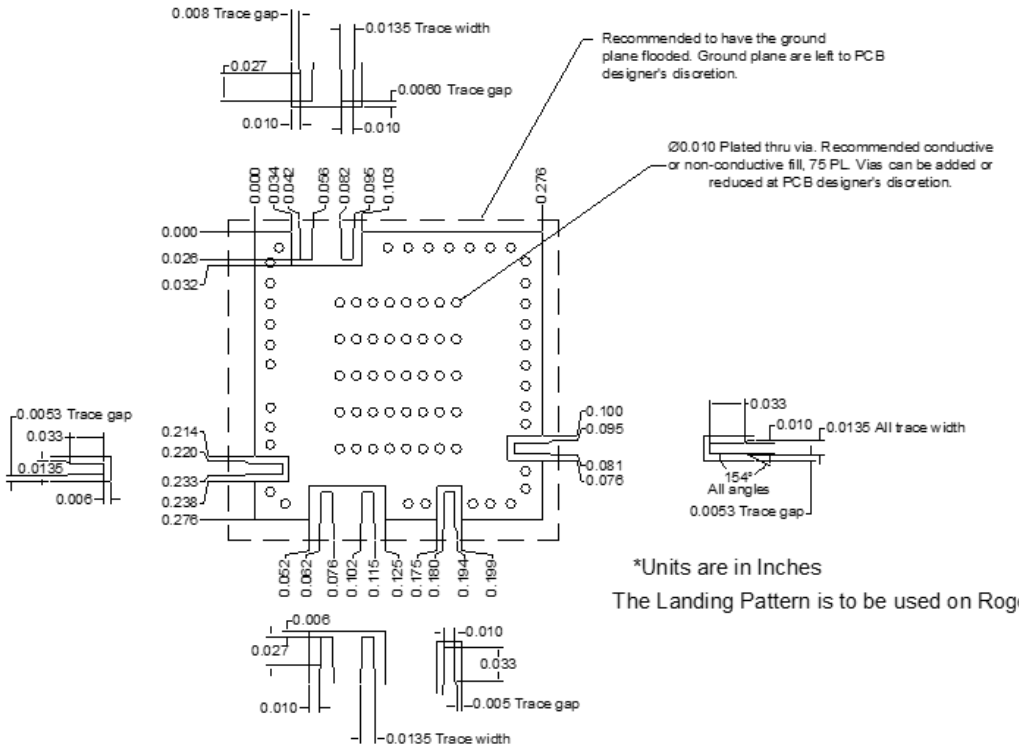
Outline Drawing

Download : Outline 2D Drawing



Footprint Image

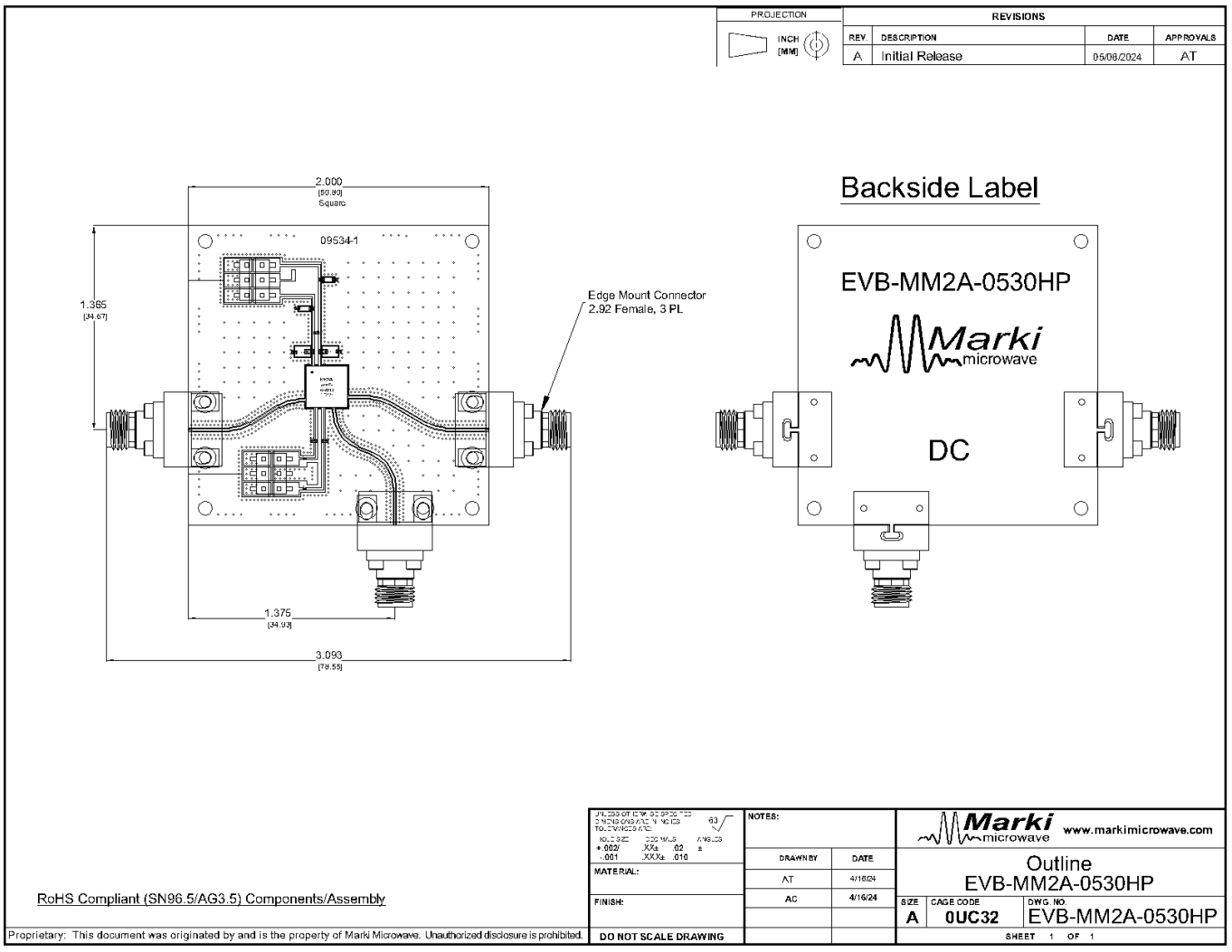
Download : Footprint Drawing



*Units are in Inches

The Landing Pattern is to be used on Rogers 4003, 0.008" thick $\frac{1}{2}$ Oz Cu.

Evaluation Board - Outline Drawing



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