



MMIC SURFACE MOUNT

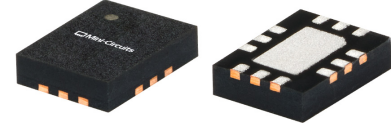
# Balun

# MTX2-133+

50Ω 1.5 to 13 GHz

### THE BIG DEAL

- Wideband, 1.5 to 13 GHz
- Low Insertion Loss, Typ. 2.2 dB
- Excellent Phase Unbalance, Typ. 2 Degrees
- Excellent Amplitude Unbalance, Typ. 0.2 dB
- Single Ended to Differential Conversion
- 3x4 mm 12-Lead QFN-Style Package

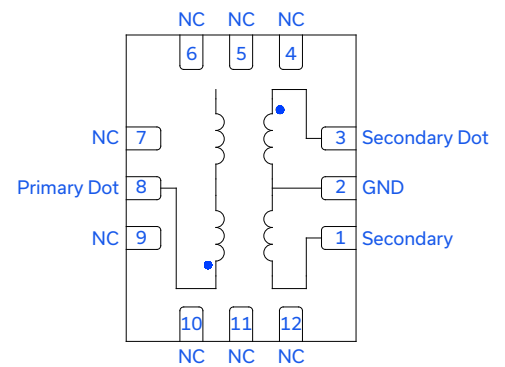


Generic photo used for illustration purposes only

### APPLICATIONS

- 5G MIMO and Back Haul Radio Systems
- Test and Measurement Equipment
- Radar, EW, and ECM Defense Systems
- Signal Distribution Networks

### FUNCTIONAL DIAGRAM



### PRODUCT OVERVIEW

Mini-Circuits MTX2-133+ is a wideband MMIC balun transformer with an impedance ratio of 1:2 applicable for a wide range of applications from 1.5 to 13 GHz. Fabricated using GaAs process technology. The MMIC provides outstanding repeatability with low insertion loss, low amplitude unbalance, low phase unbalance, and excellent common mode rejection.

### KEY FEATURES

Features	Advantages
Wideband, 1.5 to 13 GHz	Supports a broad variety of applications including Test and Measurement, WLAN, 5G Microwave Radio, Radar and Electronic Warfare
Low Insertion Loss • 2.2 dB typ. (above theoretical)	Enables excellent signal power transmission from input to output.
Excellent Common Mode Rejection • 35 dB typ.	Enables rejection of undesired signals
3x4 mm 12-Lead QFN-style package	Small footprint saves space in dense layouts while providing low inductance, repeatable transitions, and excellent thermal contact to the PCB.

**ELECTRICAL SPECIFICATIONS<sup>1</sup> AT +25°C, UNLESS NOTED OTHERWISE**

Parameter	Frequency (GHz)	Min.	Typ.	Max.	Units
Impedance Ratio (Secondary / Primary)			2		
Frequency Range		1.5		13	GHz
Average Insertion Loss (Above 3 dB Theoretical)	1.5 - 3		2.1	4.3	dB
	3 - 10		1.8	2.6	
	10 - 13		3.1	6.4	
Amplitude Unbalance	1.5 - 3		0.7	1.1	dB
	3 - 10		0.2	1.1	
	10 - 13		0.2	1.3	
Phase Unbalance <sup>2</sup>	1.5 - 3		2	9	Degree
	3 - 10		1	8	
	10 - 13		2	10	
Common Mode Rejection Ratio (CMRR)	1.5 - 3		23		dB
	3 - 10		37		
	10 - 13		37		
Input Return Loss	1.5 - 3	4	11		dB
	3 - 10	8	13		
	10 - 13	9	17		

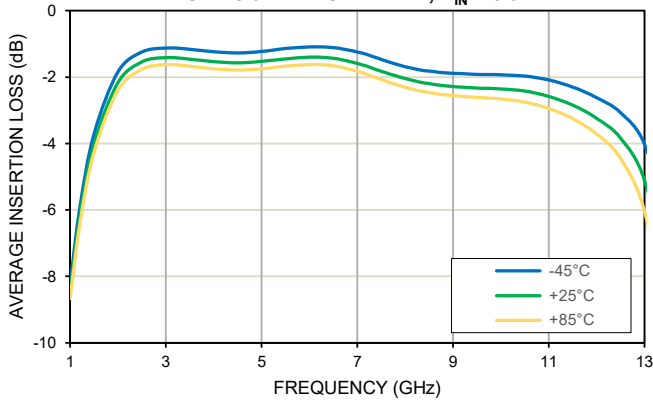
1. Tested in Mini-Circuits Evaluation Board TB-MTX2-133C+.

2. Relative to 180°

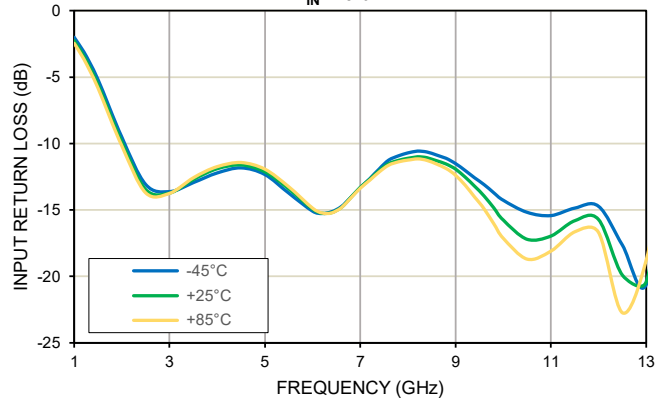


### TYPICAL PERFORMANCE GRAPHS

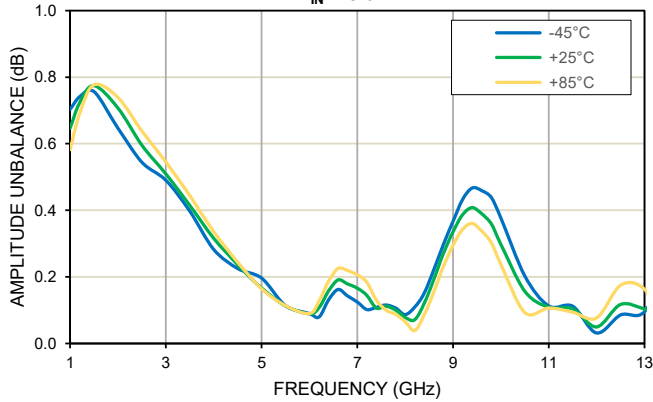
**AVERAGE INSERTION LOSS VS. TEMPERATURE**  
ABOVE 3 dB THEORETICAL,  $P_{IN} = 0$  dBm



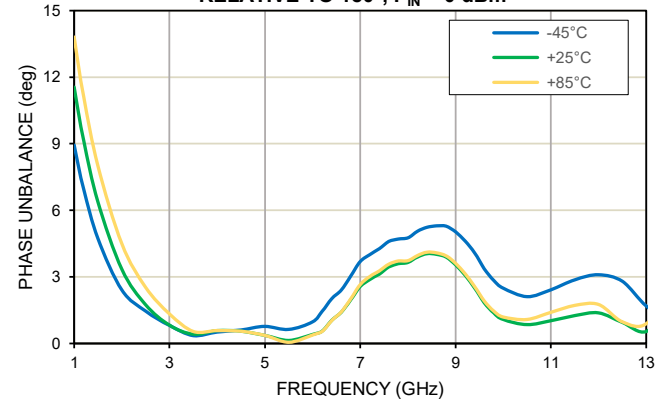
**INPUT RETURN LOSS VS. TEMPERATURE**  
 $P_{IN} = 0$  dBm



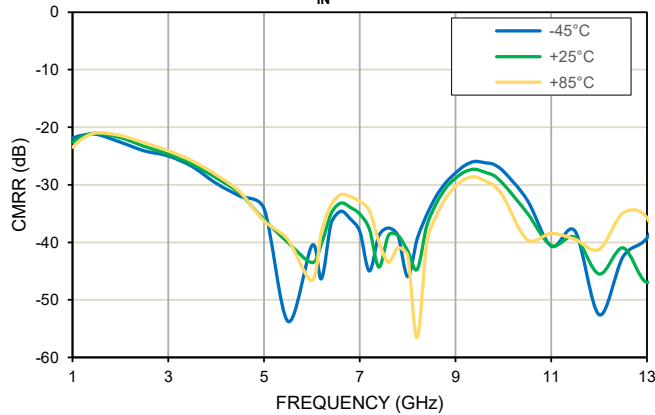
**AMPLITUDE UNBALANCE VS. TEMPERATURE**  
 $P_{IN} = 0$  dBm



**PHASE UNBALANCE VS. TEMPERATURE**  
RELATIVE TO 180°,  $P_{IN} = 0$  dBm



**CMRR VS. TEMPERATURE**  
 $P_{IN} = 0$  dBm



**ABSOLUTE MAXIMUM RATINGS<sup>3</sup>**

Parameter	Ratings
Operating Temperature (ground lead)	-45°C to +85°C
Storage Temperature	-65°C to +150°C
RF Input Power	2 W

3. Permanent damage may occur if any of these limits are exceeded.

**ESD RATING**

	Class	Voltage Range	Reference Standard
HBM	1C	1000 to < 2000V	ANSI/ESDA/JEDEC JS-001-2017



ESD HANDLING PRECAUTION: This device is designed to be Class 1C for HBM. Static charges may easily produce potentials higher than this with improper handling and can discharge into DUT and damage it. As a preventive measure Industry standard ESD handling precautions should be used at all times to protect the device from ESD damage.

**MSL RATING**

Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020E/JEDEC J-STD-033C



### FUNCTIONAL DIAGRAM

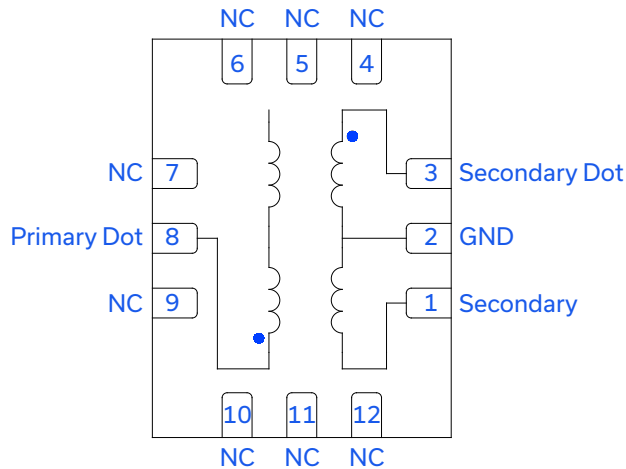


Figure 1. MTX2-133+ Functional Diagram

### PAD DESCRIPTION

Function	Pad Number	Description (Refer to Fig 2)
Primary Dot	8	Common UnBalanced RF Port
Secondary Dot	3	Balanced RF Port
Secondary	1	Balanced RF Port
GND	2	External ground.
NC	4-7, 9-12	No connection. Connected to ground on the test board.

### EVALUATION BOARD

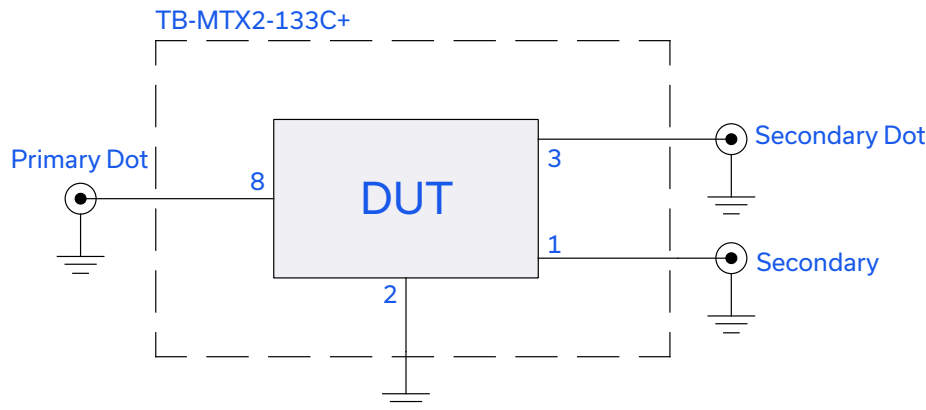


Figure 2. DUT soldered on Mini-Circuits Evaluation Board: TB-MTX2-133C+

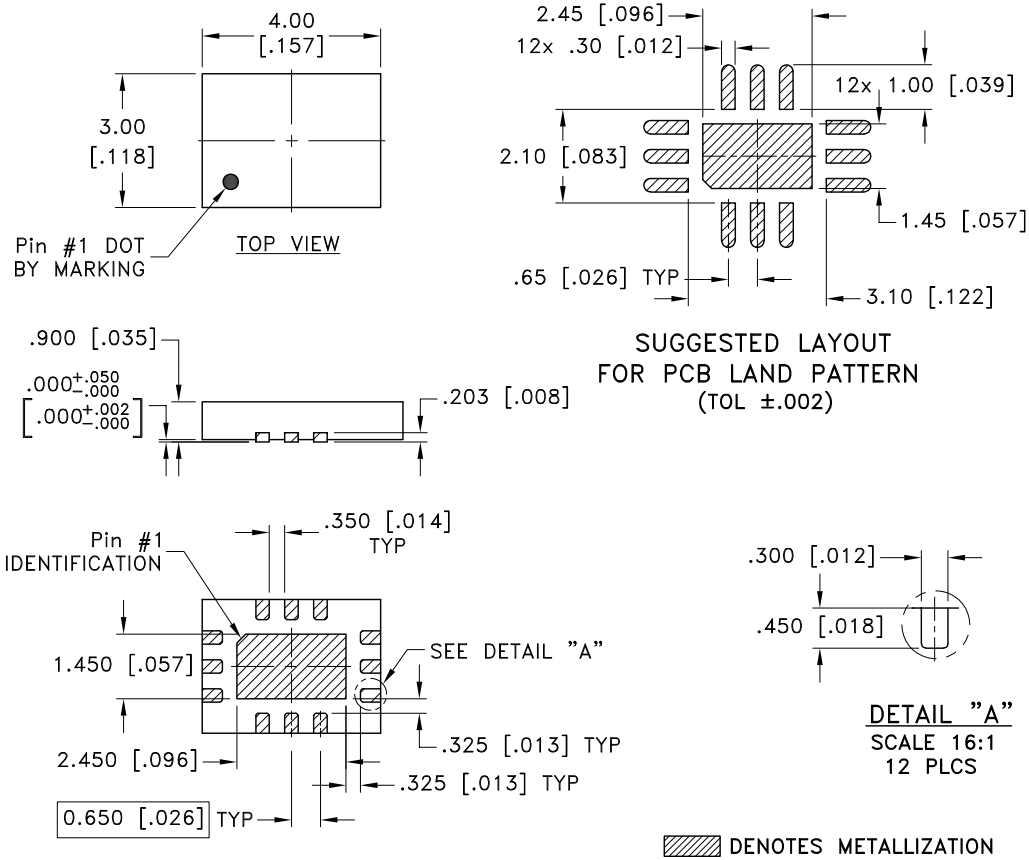
#### Electrical Parameters and Conditions

Insertion Loss, Amplitude Unbalance, Phase Unbalance, Common Mode Rejection measured using N5242A PNA-X microwave network analyzer.

Conditions:  
1.  $P_{IN} = 0$  dBm

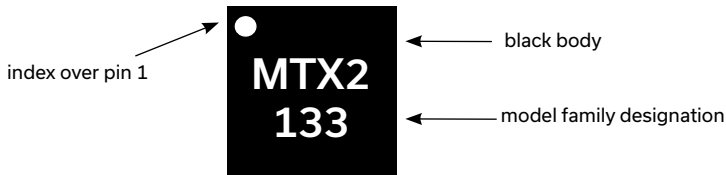


### CASE STYLE DRAWING



Weight: 0.032 grams  
 Dimensions are in mm [inches]. Tolerances 3 Pl. ±0.05 [0.002] mm [Inch]

### PRODUCT MARKING



Marking may contain other features or characters for internal lot control



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50Ω 1.5 to 13 GHz

Mini-Circuits

ADDITIONAL DETAILED INFORMATION IS AVAILABLE ON OUR DASH BOARD

[CLICK HERE](#)

<b>Performance Data &amp; Graphs</b>	Data Graphs S-Parameter (S3P Files) Data Set (.zip file)
<b>Case Style</b>	DG3006. Plastic package, exposed paddle, Lead Finish: Matte-Tin
<b>RoHS Status</b>	Compliant
<b>Tape &amp; Reel</b> Standard quantities available on reel	F68 7" or 13" reels with 20, 50, 100, 200, 500, 1K, 2K, 3K or 4K devices
<b>Suggested Layout for PCB Design</b>	PL-754
<b>Evaluation Board</b>	TB-MTX2-133C+ Gerber File
<b>Environmental Ratings</b>	ENV08T1

#### NOTES

- Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
- The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at [www.minicircuits.com/terms/viewterm.html](http://www.minicircuits.com/terms/viewterm.html)

