

Abstract

THOR μSXSB-2089 is a high high linearity InGaP/GaAs Heterojunction Bipolar Transistor (HBT) MMIC designed for operation from 5 to 2500 MHz. This application note illustrates application circuits for 450MHz (Mobile Wireless Band) & 2140MHz (UMTS Band).

Introduction

The application circuits herein were designed to achieve the optimum combination of linearity, input return loss, and stability. All recommended components are standard values available from well-known manufacturers. Components specified in the bill of materials (BOM) have known parasitics which in some cases are critical to the circuit's performance. Deviating from the recommended BOM may result in a performance shift due to varying parasitics. Matching component placement is critical to each circuit's performance.

Circuit Details

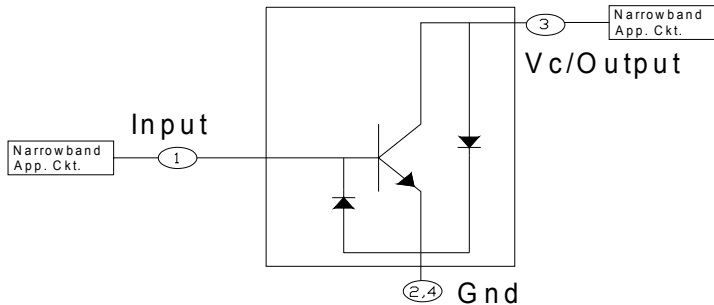
RFMD will provide the detailed layout (AutoCad format) to users wishing to use the exact same layout and substrate material shown in the following circuits. The circuits recommended within this application note were designed using the following PCB material:

- Material: GETEK™ ML200C
- Core thickness: 0.031"
- Copper cladding: 0.5 oz both sides
- Dielectric constant: 4.1 (at 1 MHz)
- Dielectric loss tangent: 0.0089 (at 1 GHz)

Customers not wishing to use the exact material and layouts shown in this application note can design their own PCB using the critical transmission line impedances and phase lengths shown in the BOMs and layouts.

NOTE: Many of our sample evaluation boards may come with an additional substrate & copper layer for mechanical stability. It has been assumed that the backside layer has no effect on the RF performance or circuit design.

Simplified Device Schematic with ESD diodes

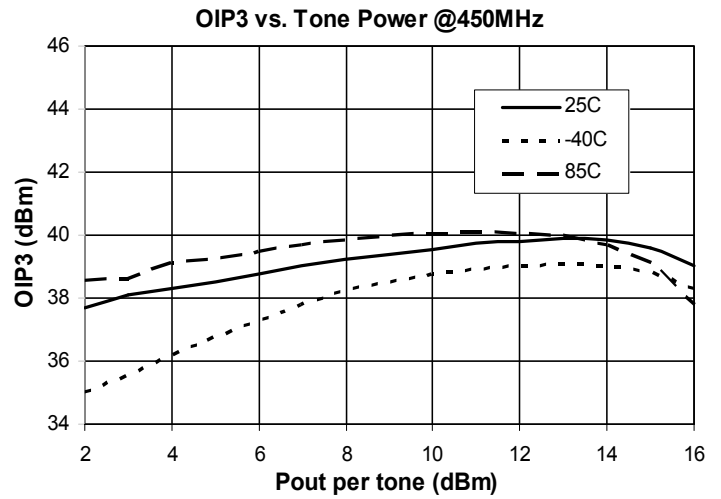
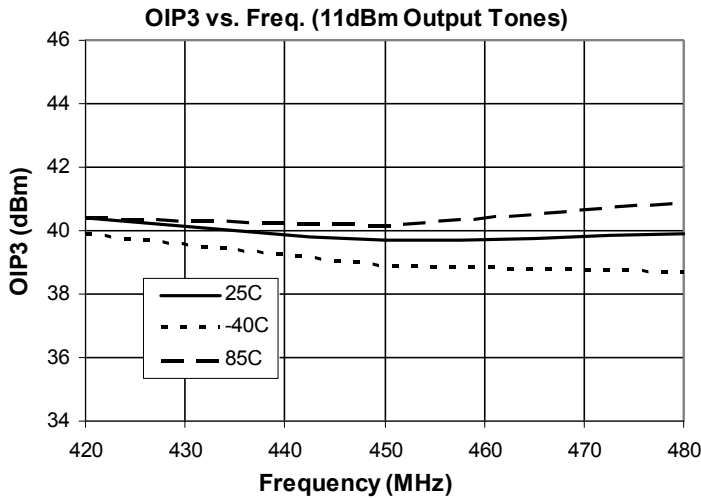
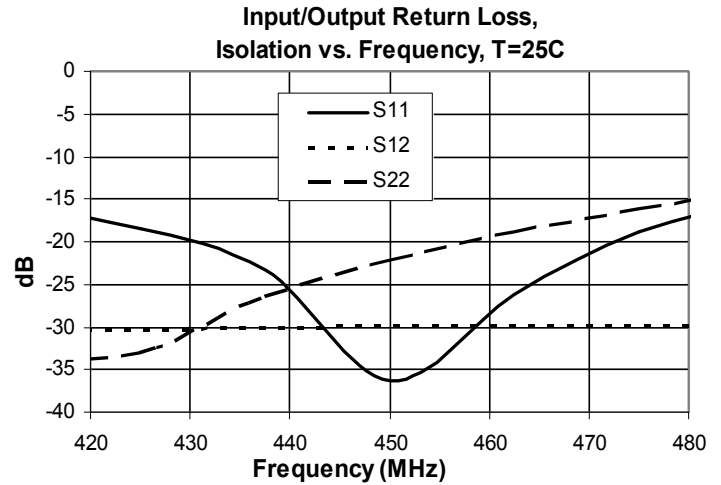
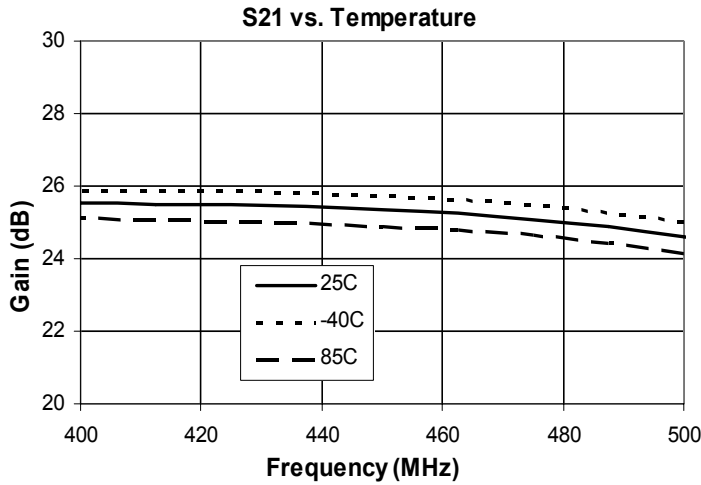
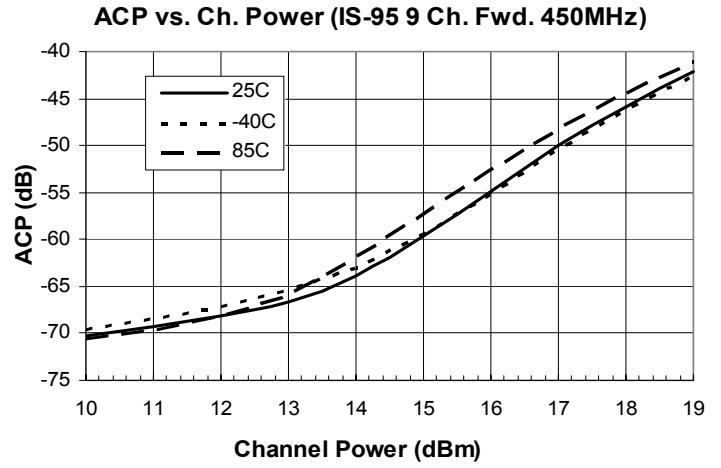
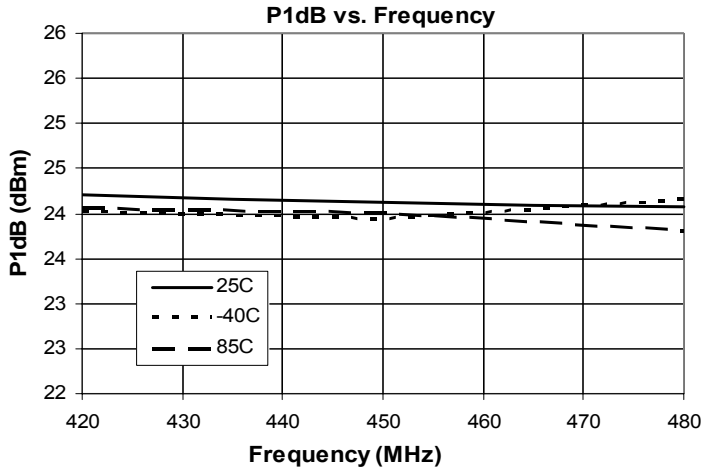


Performance Summary										
Freq.(MHz)	Vd (V)	Id (mA)	P1dB	OIP3	ACP Ch. Pwr.	NF	S11	Gain	Isol	S22
420	5.2	135	24.2	40.4		4.6	-17.9	25.4	-30.2	-33.8
450	5.2	135	24.1	39.7	16.0	4.9	-32.8	25.3	-30.0	-24.4
480	5.2	135	24.1	39.9		5.3	-20.1	25.1	-29.9	-17.1
2110	5.2	135	24.8	43.0		4.1	-18.1	17.1	-23.1	-21.5
2140	5.2	135	24.7	43.6	15.6	4.2	-19.3	17.1	-23.0	-22.9
2170	5.2	135	24.7	43.9		4.4	-16.4	16.9	-23.0	-22.0

Vs=8V, R_{Bias}=20 Ohm, T=+25C
 IP3 with 11dBm Tones/1MHz spacing
 ACP Ch. Pwr. at 450MHz = -55dBc IS-95 with 9Ch. Fwd
 ACP Ch. Pwr. at 2140MHz = -50dBc WCDMAwith 64Ch. Fwd

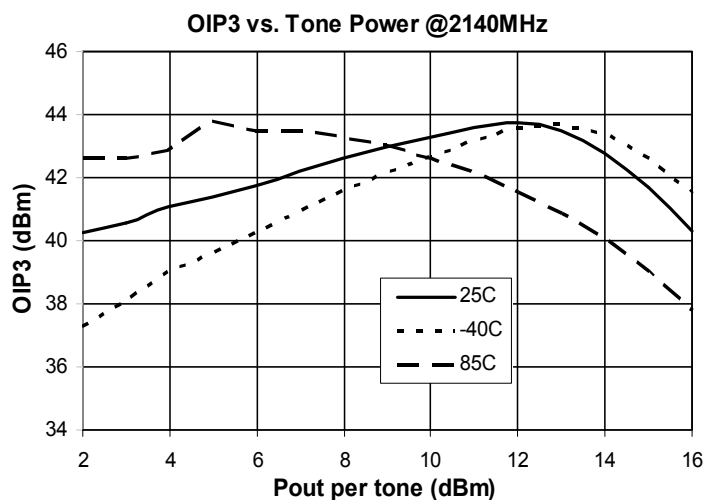
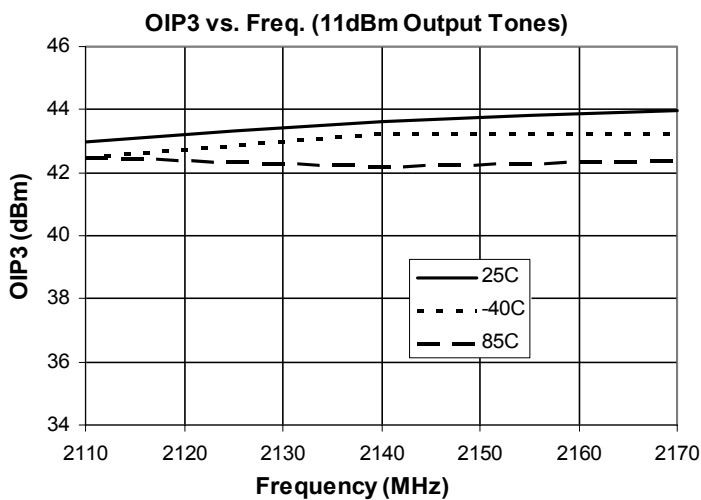
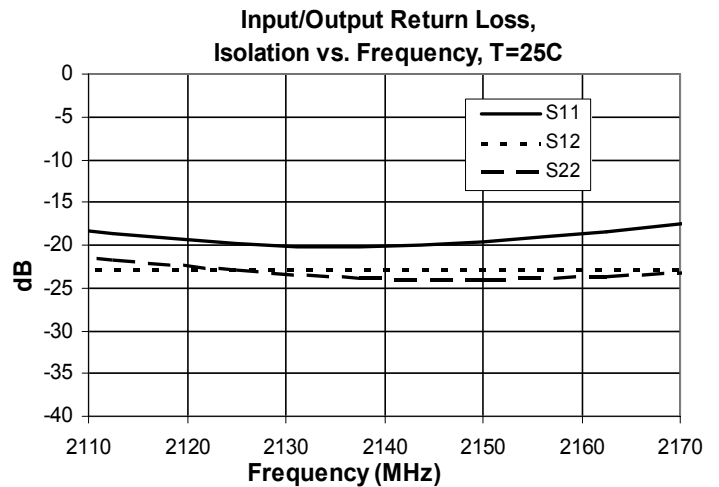
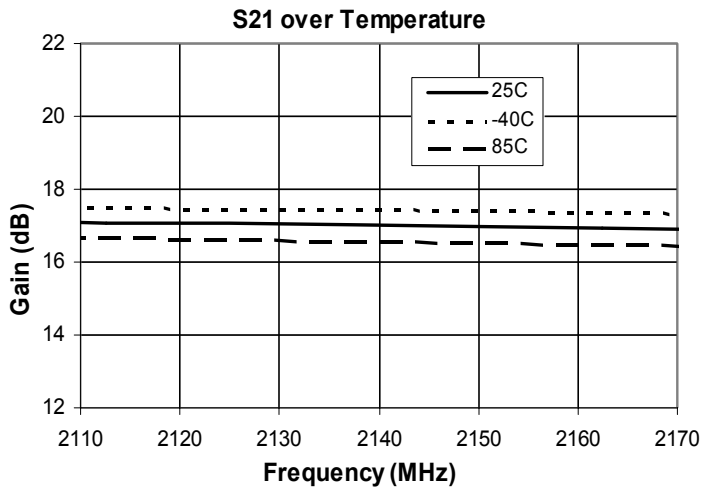
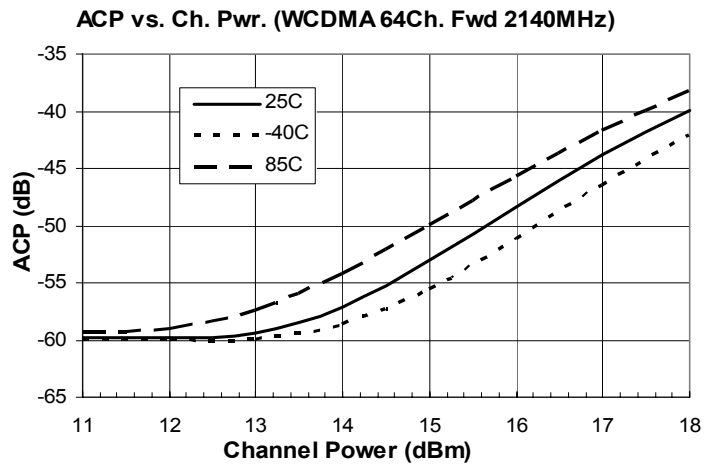
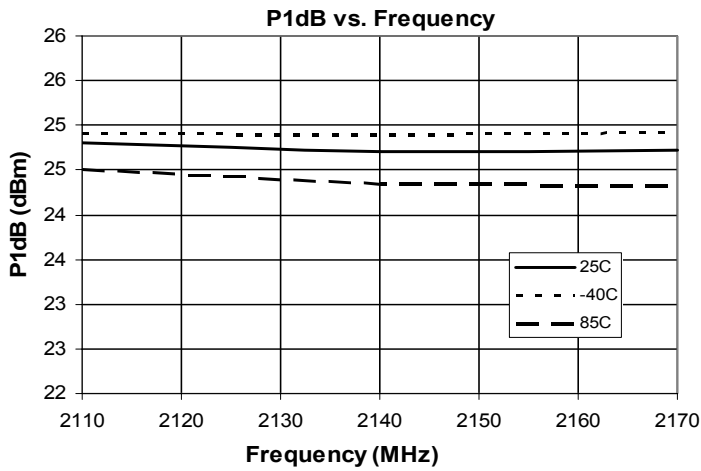
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450 MHz Application Circuit Data, $I_D=135mA$, $T=+25C$, $R_{Bias}=20\text{ Ohm}$, $V_S=8V$



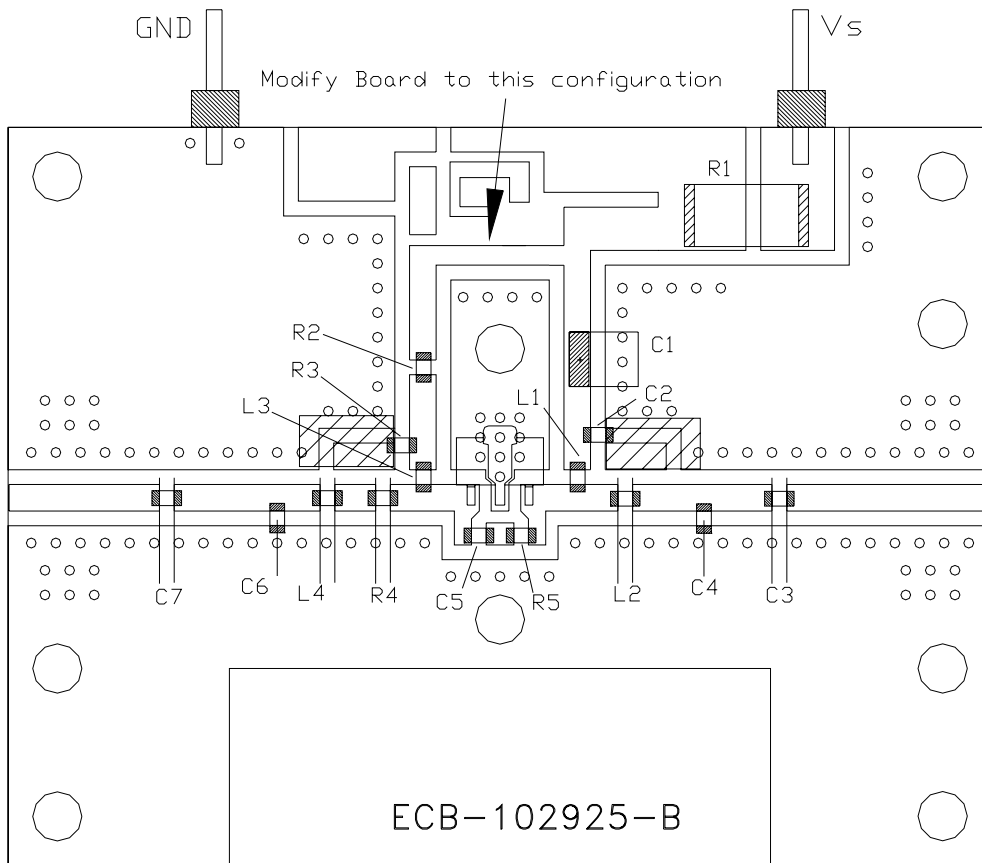
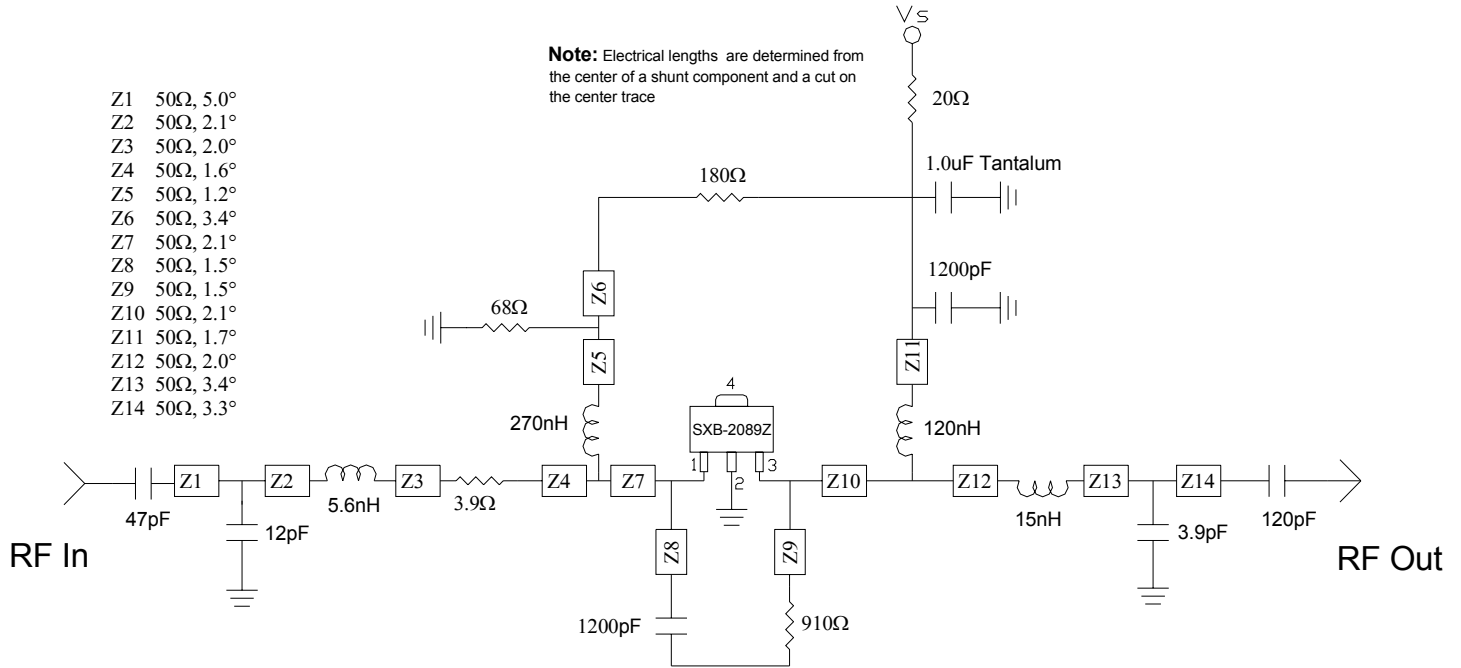
880 MHz & 1960MHz Application Circuits available in Datasheet at www.RFMD.com

2140 MHz Application Circuit Data, $I_D=135mA$, $T=+25C$, $R_{Bias}=20\text{ Ohm}$, $V_S=8V$



880 MHz & 1960MHz Application Circuits available in Datasheet at www.RFMD.com

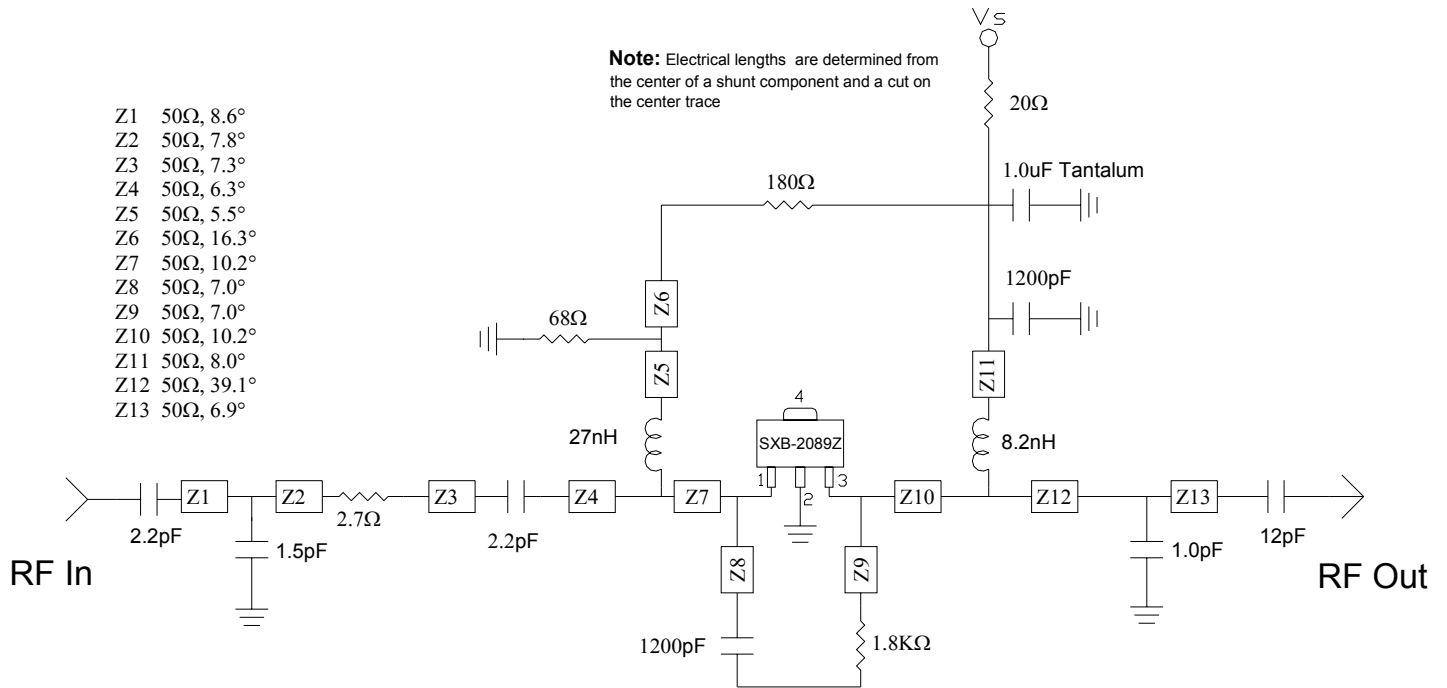
Application Schematic & Assembly Drawing 450MHz Circuit



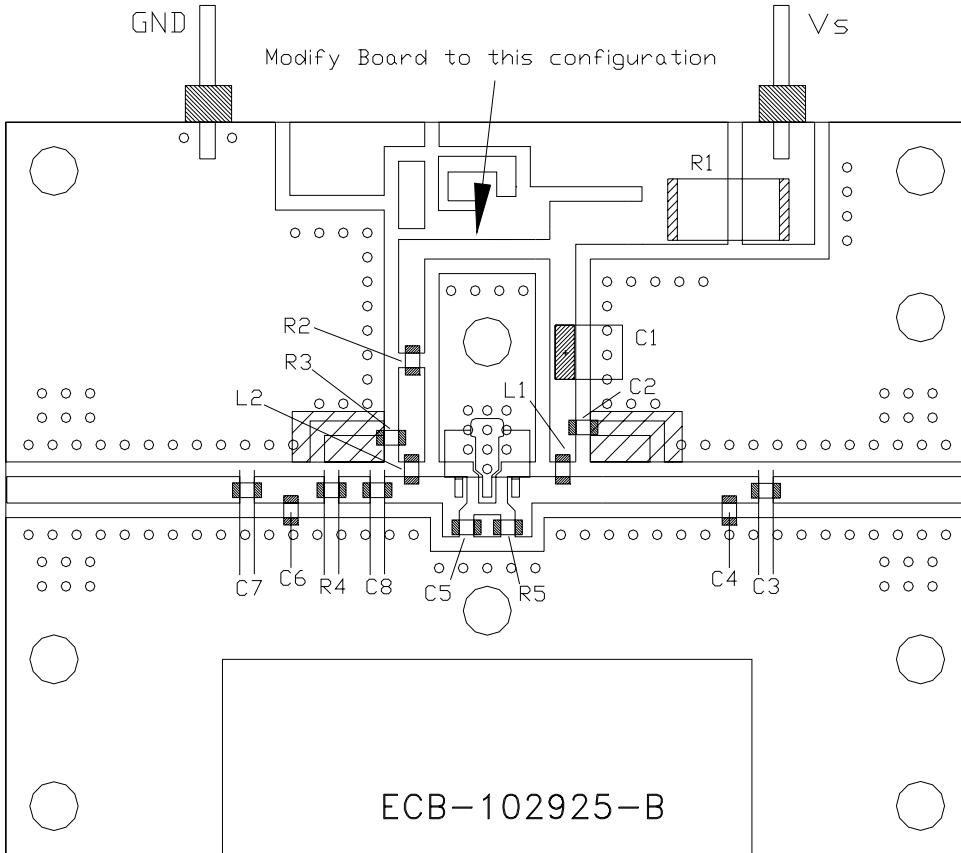
Bill of Materials

C1	TAJB105KLRH	Rohm	1.0uF
C2,C5	MCH185C122KK	Rohm	1200pF
C3	MCH185A121JK	Rohm	120pF
C4	MCH185A3R9CK	Rohm	3.9pF
C6	MCH185A120JK	Rohm	12pF
C7	MCH185A470JK	Rohm	47pF
L1	LL1608-FSR12J	Toko	120nH
L2	LL1608-FS15NJ	Toko	15nH
L3	LL1608-FSR27J	Toko	270nH
L4	LL1608-FS5N6S	Toko	5.6nH
R1	20Ω	2512 res	(1%)
R2	180Ω	0603 res	(5%)
R3	68Ω	0603 res	(5%)
R4	3.9Ω	0603 res	(5%)
R5	910Ω	0603 res	(5%)
Connectors	2x PSF-S01-1mm GigaLane Co.		
Heat sink	EEF-101407		
PCB	ECB-102925-B		

Application Schematic & Assembly Drawing 2140MHz Circuit



- Z1 50Ω, 8.6°
- Z2 50Ω, 7.8°
- Z3 50Ω, 7.3°
- Z4 50Ω, 6.3°
- Z5 50Ω, 5.5°
- Z6 50Ω, 16.3°
- Z7 50Ω, 10.2°
- Z8 50Ω, 7.0°
- Z9 50Ω, 7.0°
- Z10 50Ω, 10.2°
- Z11 50Ω, 8.0°
- Z12 50Ω, 39.1°
- Z13 50Ω, 6.9°



Bill of Materials

- C1 TAJB105KLRH Rohm 1.0uF
- C2,C5 MCH185C122KK Rohm 1200pF
- C3 MCH185A120JK Rohm 12pF
- C4 MCH185A010CK Rohm 1.0pF
- C6 MCH185A1R5CK Rohm 1.5pF
- C7,C8 MCH185A4R7CK Rohm 2.2pF
- L1 LL1608-FS8N2J Toko 8.2nH
- L2 LL1608-FS270JK Toko 27nH
- R1 20Ω 2512 res (1%)
- R2 180Ω 0603 res (5%)
- R3 68Ω 0603 res (5%)
- R4 2.7Ω 0603 res (5%)
- R5 1.8KΩ 0603 res (5%)
- Connectors 2x PSF-S01-1mm GigaLane Co.
- Heat sink EEF-101407
- PCB ECB-102925-B