



Package: SOT-343

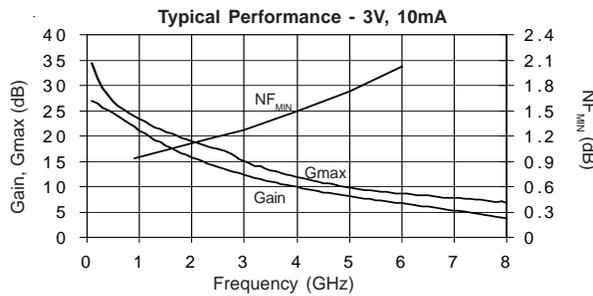


### Product Description

RFMD's SGA8343Z is a high performance Silicon Germanium Heterostructure Bipolar Transistor (SiGe HBT) designed for operation from DC to 6GHz. The SGA8343Z is optimized for 3V operation but can be biased at 2V for low-voltage battery operated systems. The device provides high gain, low NF, and excellent linearity at a low cost. It can be operated at very low bias currents in applications where high linearity is not required. The matte tin finish on the lead-free package utilizes a post annealing process to mitigate tin whisker formation and is RoHS compliant per EU Directive 2002/95. This package is also manufactured with green molding compounds that contain no antimony trioxide nor halogenated fire retardants.

**Optimum Technology Matching® Applied**

- GaAs HBT
- GaAs MESFET
- InGaP HBT
- SiGe BiCMOS
- Si BiCMOS
- SiGe HBT
- GaAs pHEMT
- Si CMOS
- Si BJT
- GaN HEMT
- InP HBT
- RF MEMS
- LDMOS



### Features

- DC to 6GHz Operation
- 0.9dB NF<sub>MIN</sub> at 0.9GHz
- 24dB GMAX at 0.9GHz
- |GOPT|=0.10 at 0.9GHz
- OIP3=+28dBm, P1dB=+9dBm
- Low Cost, High Performance, Versatility

### Applications

- Analog and Digital Wireless Systems
- 3G, Cellular, PCS, RFID
- Fixed Wireless, Pager Systems
- Driver Stage for Low Power Applications
- Oscillators

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Maximum Available Gain		23.9		dB	0.9GHz, Z <sub>S</sub> =Z <sub>S</sub> <sup>*</sup> , Z <sub>L</sub> =Z <sub>L</sub> <sup>*</sup>
		19.3		dB	1.9GHz
		17.7		dB	2.4GHz
Minimum Noise Figure		0.94		dB	0.9GHz, Z <sub>S</sub> =Gamma <sub>OPT</sub> , Z <sub>L</sub> =Z <sub>L</sub> <sup>*</sup>
		1.10		dB	1.9GHz
		1.18		dB	2.4GHz
Insertion Gain	21.0	22.0	23.0	dB	0.9GHz, Z <sub>S</sub> =Z <sub>L</sub> =50Ω <sup>[1]</sup>
Noise Figure		1.40	1.75	dB	1.9GHz, LNA Application Circuit Board <sup>[2]</sup>
Gain	15.5	16.5	17.5	dB	1.9GHz, LNA Application Circuit Board <sup>[2]</sup>
Output Third Order Intercept Point	25.8	27.8		dBm	1.9GHz, LNA Application Circuit Board <sup>[2]</sup>
Output 1dB Compression Point	7.5	9.0		dBm	1.9GHz, LNA Application Circuit Board <sup>[2]</sup>
DC Current Gain	120	180	300		
Breakdown Voltage	5.7	6.0		V	collector - emitter
Thermal Resistance		200		°C/W	junction - lead
Operating Voltage			4.0	V	collector - emitter
Operating Current			50	mA	collector - emitter

Test Conditions<sub>CE</sub>=3V, I<sub>CO</sub>=10mA, 25°C (unless otherwise noted), [1] 100% tested - Insertion gain tested using a 50W contact board (no matching circuitry) during final production test. [2] Sample tested - Samples pulled from each wafer/package lot. Sample test specifications are based on statistical data from sample test measurements. The test fixture is an engineering application circuit board (parts are pressed down on the board). The application circuit represents a trade-off between the optimal noise match and input return loss.

## Absolute Maximum Ratings

Parameter	Rating	Unit
Collector Current (ICE)	72	mA
Base Current (IB)	1	mA
Collector - Emitter Voltage (VCE)	5	V
Collector - Base Voltage (VCB)	12	V
Emitter - Base Voltage (VEB)	4.5	V
RF Input Power (PIN)	5	dBm
Storage Temperature Range (TSTOR)	-40 to +150	°C
Power Dissipation (PDISS)	350	mW
operating Junction Temperature (TJ)	+150	°C



**Caution!** ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EU Directive 2002/95/EC (at time of this document revision).

The information in this publication is believed to be accurate and reliable. However, no responsibility is assumed by RF Micro Devices, Inc. ("RFMD") for its use, nor for any infringement of patents, or other rights of third parties, resulting from its use. No license is granted by implication or otherwise under any patent or patent rights of RFMD. RFMD reserves the right to change component circuitry, recommended application circuitry and specifications at any time without prior notice.

Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.

## Typical Performance - Engineering Application Circuits

Freq (GHz)	VS (V)	VCE (V)	ICQ (mA)	NF (dB)	Gain (dB)	P1dB (dBm)	OIP3 <sup>[1]</sup> (dBm)	S11 (dB)	S22 (dB)	Comments
0.90	53.0	3.0	12	1.25	18.2	9	27.3	-16	-18	series feedback
1.575	3.3	2.7	10	1.25	15.7	6.8	26.5	-10	-25	
1.90	5.0	3.0	12	1.4	16.5	9	27.8	-9	-24	
2.40	3.3	2.7	10	1.6	14.4	9	27.5	-13	-24	

[3] POUT=0dBm per tone, 1MHz tone spacing.

Refer to the application note for additional RF data, PCB layouts, BOMs, biasing instructions, and other key issue to be considered.

## Peak Performance Under Optimum Matching Conditions

Freq (GHz)	VCE (V)	ICQ (mA)	NF (dB) <sup>[2]</sup>	GMAX (dB)	P1dB (dBm) <sup>[4]</sup>	OIP3 (dBm) <sup>[4]</sup>
0.90	2	10	0.90	23.7	10	25
0.90	3	10	0.94	23.9	13	29
1.90	2	10	1.05	19.1	10	25
1.90	3	10	1.10	19.3	13	29
2.40	2	10	1.15	17.4	10	25
2.40	3	10	1.18	17.7	13	29

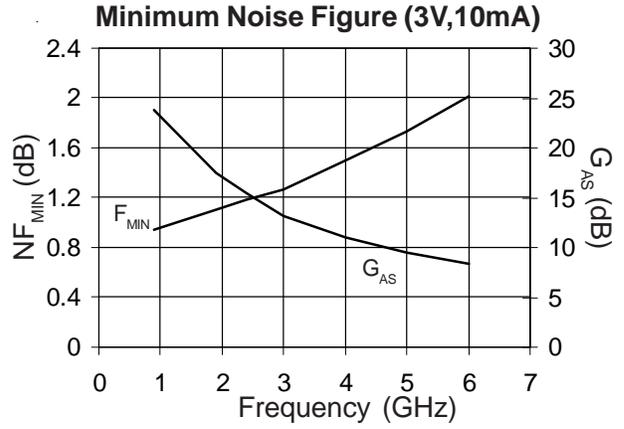
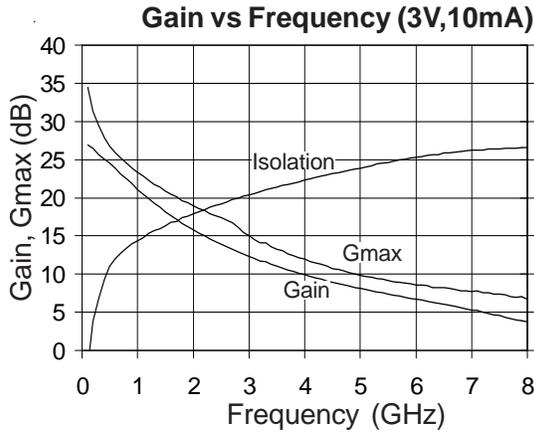
[2]  $Z_S = \Gamma_{OPT}$ ,  $Z_L = Z_L^*$ , The input matching circuit loss have been de-embedded.

[3]  $Z_S = Z_{SOPT}$ ,  $Z_L = Z_{LOPT}$ , where  $Z_{SOPT}$  and  $Z_{LOPT}$  have been tuned for max P1dB (current allowed to drive-up with constant VCE).

[4]  $Z_S = Z_{SOPT}$ ,  $Z_L = Z_{LOPT}$ , where  $Z_{SOPT}$  and  $Z_{LOPT}$  have been tuned for max OIP3.

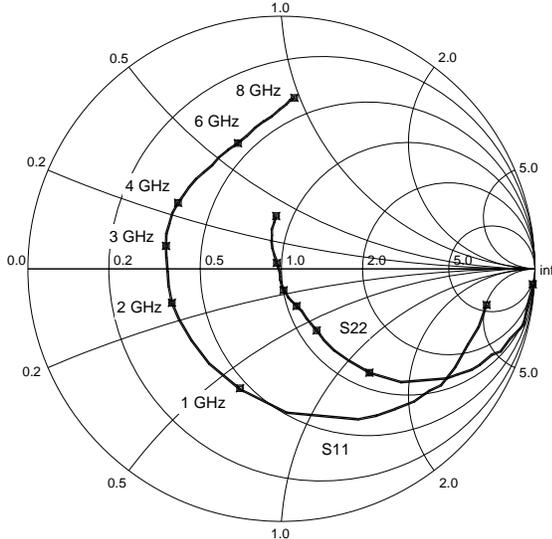
Note: Optimum NF, P1dB, and OIP3 performance cannot be achieved simultaneously.

Typical Performance - De-embedded S-Parameters



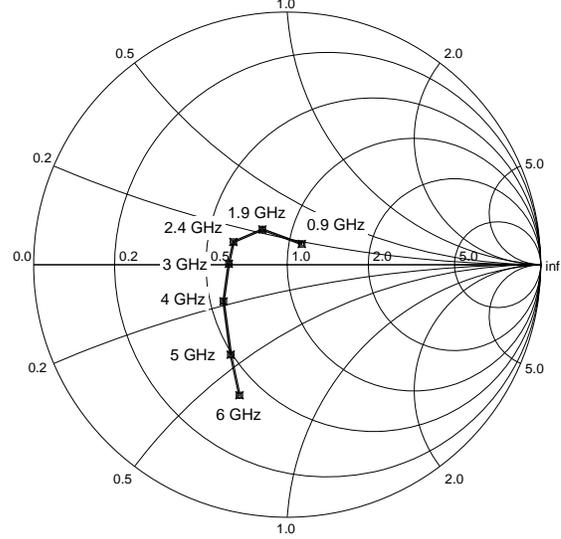
S11 versus Frequency

**S11,S22 vs Frequency (3V,10mA)**



S22 versus Frequency

**Γ<sub>OPT</sub> (3V,10mA)**



Note:

S-parameters are de-embedded to the device leads with Z<sub>S</sub>=Z<sub>L</sub>=50Ω. De-embedded S-parameters can be downloaded from our website ([www.rfmd.com](http://www.rfmd.com))

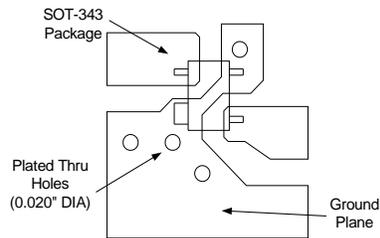
## Typical Performance - Noise Parameters - 3V, 10mA

Frequency (GHz)	NFMIN (dB) <sup>[5]</sup>	$\Gamma_{OPT}$ Mag<Ang	$r_n$ ( $\Omega$ )	GMAX (dB)
0.9	0.94	0.10<55	0.11	23.88
1.9	1.1	0.71<125	0.10	19.33
2.4	1.18	0.25<157	0.09	17.66
3	1.27	0.23<179	0.09	15.01
4	1.5	0.29<-150	0.12	11.94
5	1.73	0.42<-122	0.18	9.84
6	2.02	0.55<-110	0.24	8.62

[5]  $Z_S = \Gamma_{OPT}$ ,  $Z_L = Z_L^*$ ,  $NF_{MIN}$  is a noise parameter for which the input matching circuit losses have been de-embedded. The noise parameters were measured using a Maury Microwave Automated Tuner System. The device was mounted on a 0.010" PCB with plated-thru holes close to pins 2 and 4.

Pin	Function	Description
1	BASE	RF input/base pin.
2, 4	EMITTER	Connection to ground. Use multiple via holes to reduce emitter inductance.
3	COLLECTOR	RF output/collector bias.

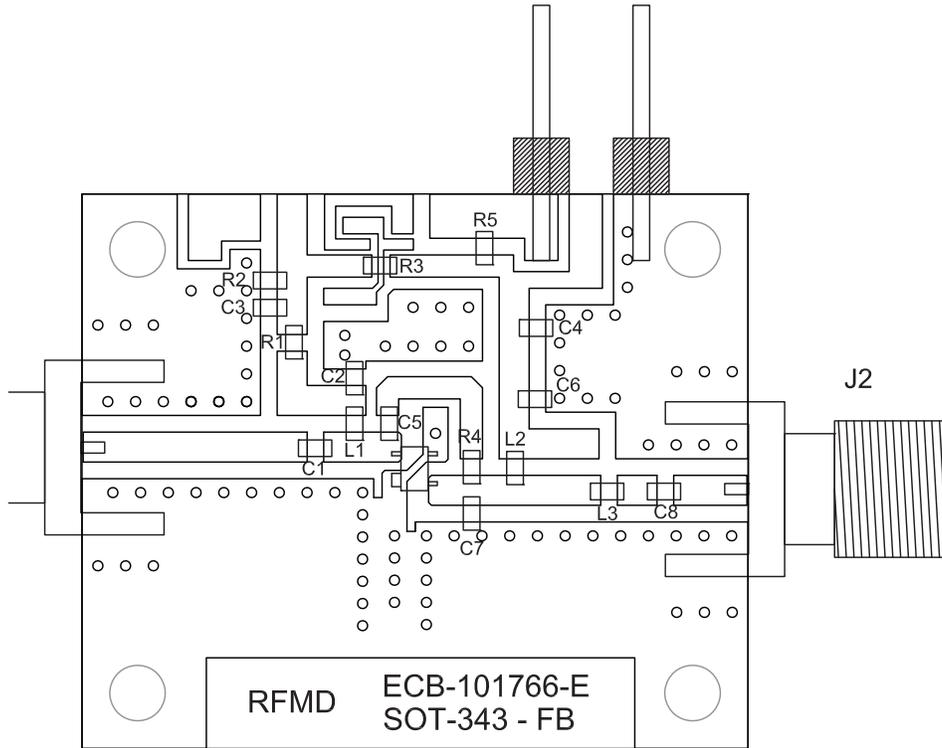
## Recommended PCB Layout



Use multiple plated-thru via holes located close to the package pins to ensure a good RF ground connection to a continuous groundplane on the backside of the board.

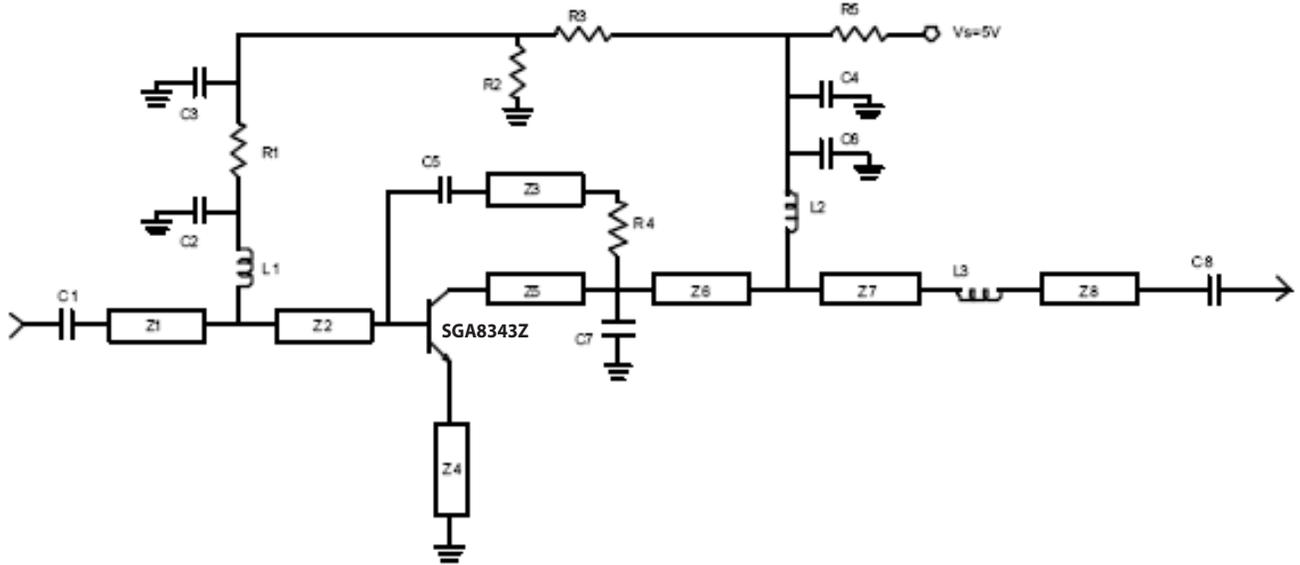


## SGA8343Z-EVB1 800MHz to 1000MHz Evaluation Board

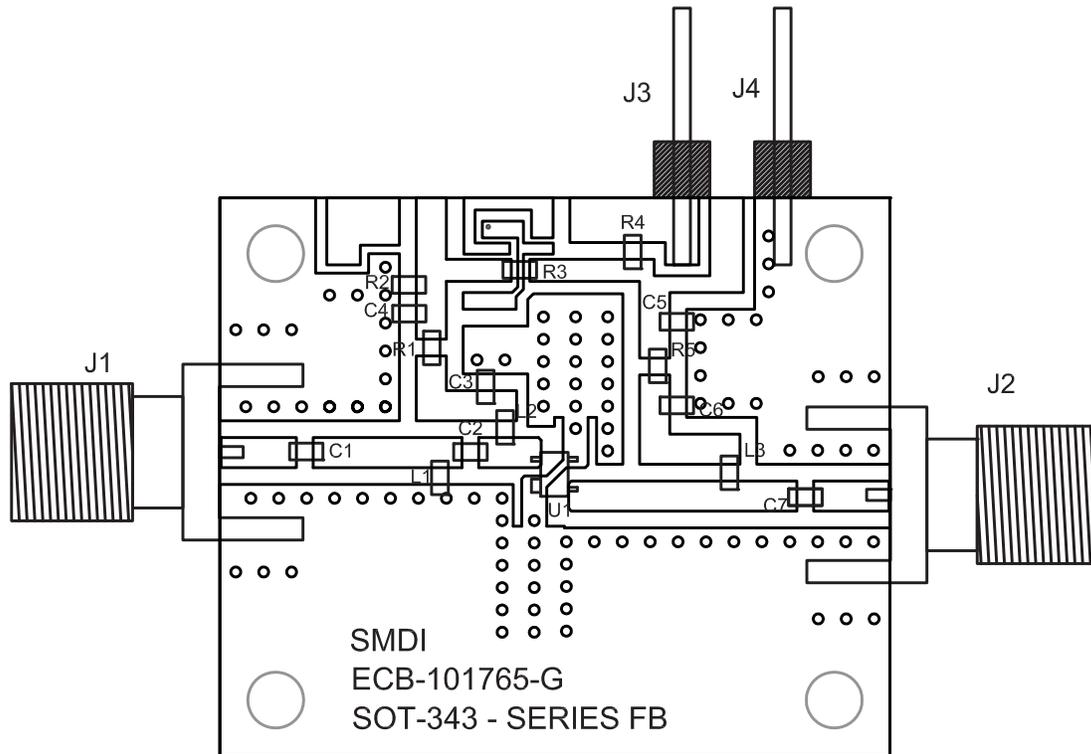


Ref. Des	Part Number	Value
C1, 2, 6, 8	ROHM MCH185A390J	39pF
C7	ROHM MCH185A0R5C	0.5pF
C3, 4, 5	Samsung CL 10B104KONC	0.1μF
L1	TOKO LL 1608-FS18NJ	18nH
L2	TOKO LL 1608-FSR12J	120nH
L3	TOKO LL 1608-FS6N8J	6.8nH
R1	ROHM MCR03J5R1	5.1Ω
R2	ROHM MCR03J911	910Ω
R3, 4	ROHM MCR03J242	2.4KΩ
R5	ROHM MCRO.J161	160Ω
Z1	non-critical	50Ω
Z2	4.0 degrees at 900MHz	50Ω
Z3	11.5 degrees at 900MHz	63Ω
Z4	5.0 degrees at 900MHz	50Ω
Z5	3.6 degrees at 900MHz	50Ω
Z6	3.7 degrees at 900MHz	50Ω
Z7	7.1 degrees at 900MHz	50Ω
Z8	non-critical	50Ω

SGA8343Z-EVB1 800MHz to 1000MHz Application Schematic

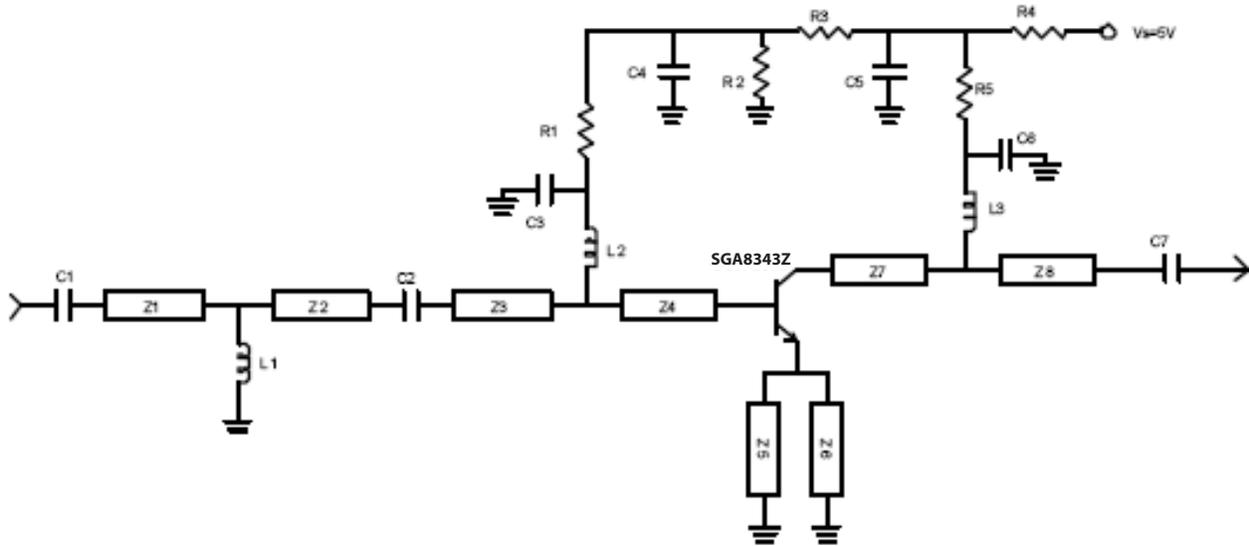


## SGA8343Z-EVB2 1800MHz to 2000MHz Evaluation Board

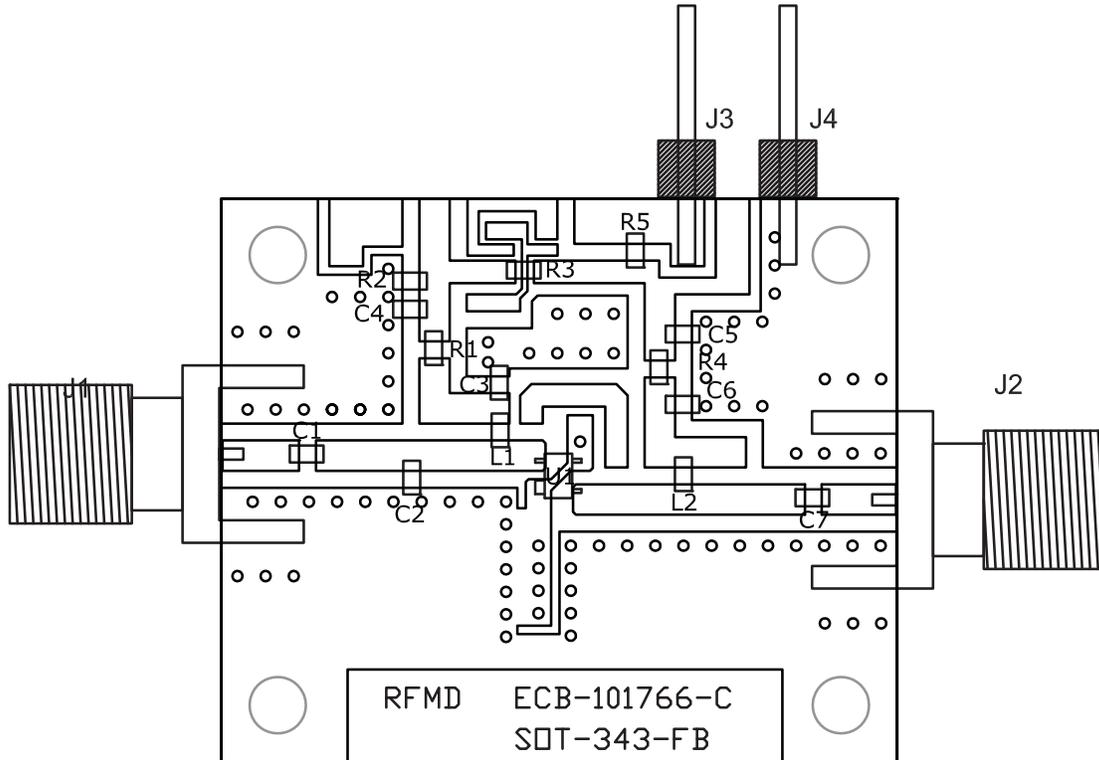


Ref. Des	Part Number	Value
C1, 7	ROHM MCH185A390J	39pF
C2	ROHM MCH185A2R2C	2.2pF
C3, 6	ROHM MCH185A100D	10pF
C4, 5	Samsung CL10B104K0NC	0.1μF
L1	TOKO LL 1608-FS3N9S	3.9nH
L2	TOKO LL 1608-FS18NJ	18nH
L3	TOKO LL 1608-FS3N3S	3.3nH
R1, 5	ROHM MCR03J5R1	5.1Ω
R2	ROHM MCR03J911	910Ω
R3	ROHM MCR03J242	2.4KΩ
R4	ROHM MCRO.J161	160Ω
Z1	non-critical	50Ω
Z2	3.9 degrees at 1900MHz	50Ω
Z3	4.7 degrees at 1900MHz	50Ω
Z4	6.4 degrees at 900MHz	50Ω
Z5	9.8 degrees at 1900MHz	50Ω
Z6	9.8 degrees at 1900MHz	50Ω
Z7	28.7 degrees at 1900MHz	50Ω
Z8	non-critical	50Ω

SGA8343Z-EVB2 1800 MHz to 2000 MHz Application Schematic

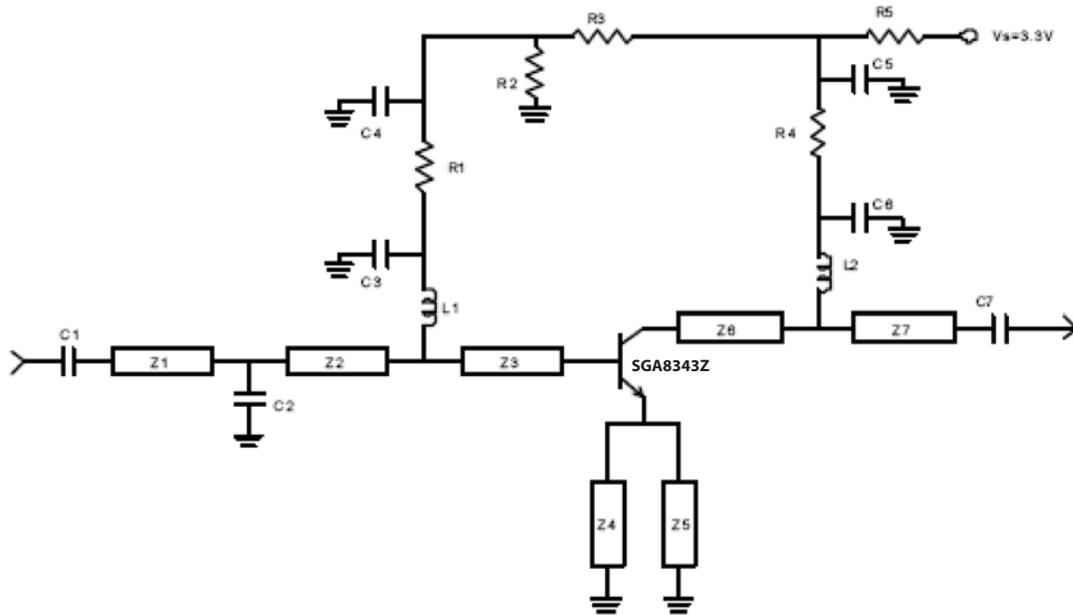


## SGA8343Z-EVB3 2400MHz to 2500MHz Evaluation Board

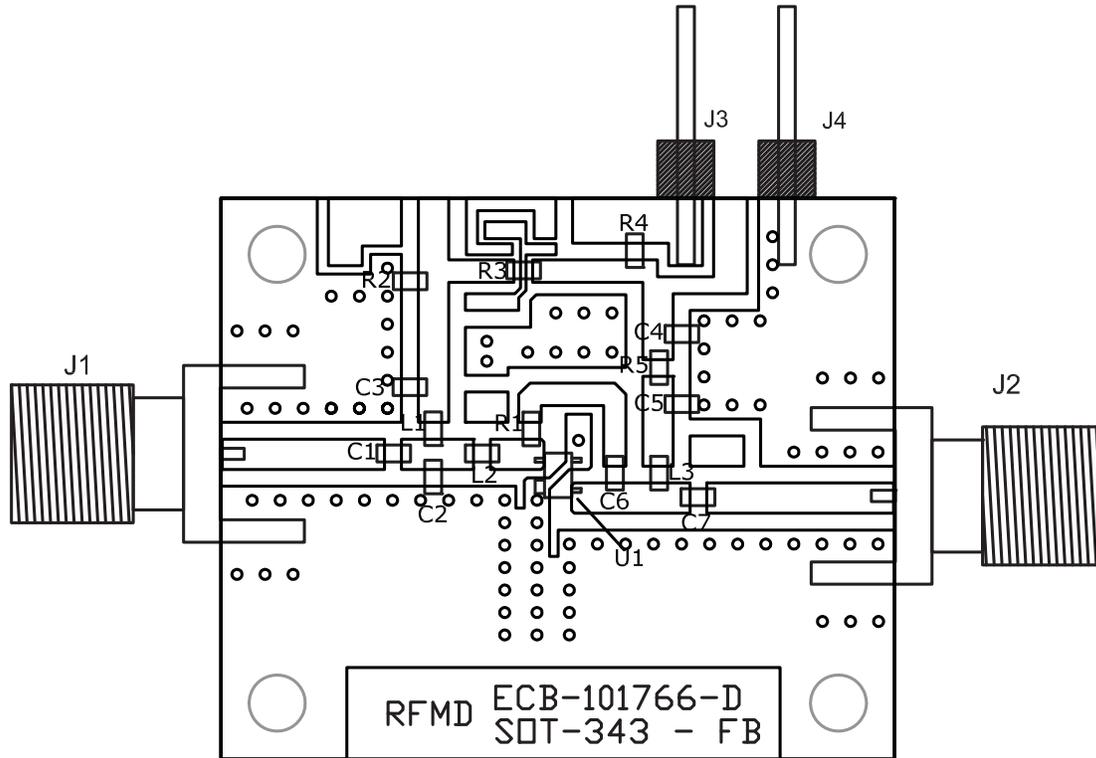


Ref. Des	Part Number	Value
C1, 3, 6, 7	ROHM MCH185A5R6D	5.6pF
C2	ROHM MCH185A010C	1.0pF
C4, 5	Samsung CL 10B104K0NC	0.1μF
L1	TOKO LL 1608-FS10NJ	10nH
L2	TOKO LL 1608-FS2N7S	2.7nH
R1, 4	ROHM MCR03J100	10Ω
R2	ROHM MCR03J102	1.1KΩ
R3	ROHM MCR03J222	2KΩ
R5	ROHM MCR50J620	62Ω
Z1	non-critical	50Ω
Z2	8.2 degrees at 2440MHz	50Ω
Z3	21.7 degrees at 2440MHz	50Ω
Z4	6.2 degrees at 2440MHz	50Ω
Z5	6.2 degrees at 2440MHz	50Ω
Z6	23.8 degrees at 2440MHz	50Ω
Z7	non-critical	50Ω

SGA8343Z-EVB3 2400 MHz to 2500 MHz Application Schematic

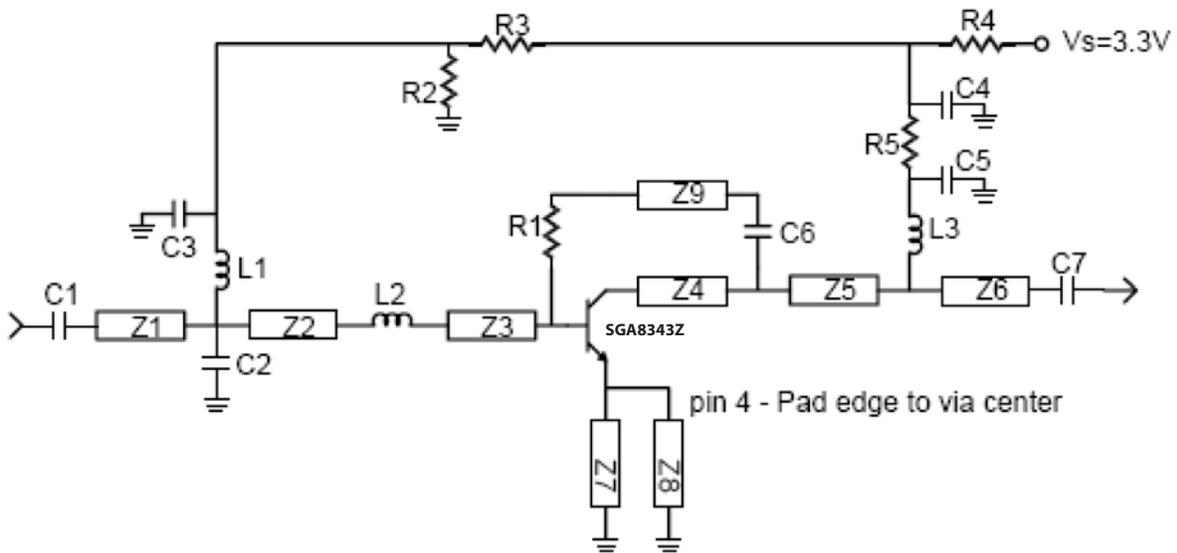


## SGA8343Z-EVB4 1575 MHz Evaluation Board



Ref. Des	Part Number	Value
C1, 5, 7	ROHM MCH185A150J	15 pF
C2	ROHM MCH185A1R2C	1.2 pF
C3, 4, 6	Samsung CL 10B104KONC	0.1 $\mu$ F
L1	TOKO LL 1608-FS39NJ	39 nH
L2	TOKO LL 1608-FS1N8S	1.8 nH
L3	TOKO LL 1608-FS3N9S	3.9 nH
R1, 3	ROHM MCR03J222	2.2K $\Omega$
R2	ROHM MCR03J102	1.0K $\Omega$
R4	ROHM MCR03J620	62 $\Omega$
R5	ROHM MCR03J100	10 $\Omega$
Z1	non-critical	50 $\Omega$
Z2	6.5 degrees at 1575 MHz	50 $\Omega$
Z3	7.8 degrees at 1575 MHz	50 $\Omega$
Z4	6.4 degrees at 1575 MHz	50 $\Omega$
Z5	6.4 degrees at 1575 MHz	50 $\Omega$
Z6	non-critical	50 $\Omega$
Z7	11.1 degrees at 1575 MHz	50 $\Omega$
Z8	6.3 degrees at 1575 MHz	50 $\Omega$
Z9	26.0 degrees at 1575 MHz	60 $\Omega$

**SGA8343Z-EVB4 1575 MHz Application Schematic**



**Ordering Information**

Ordering Code	Description
SGA8343ZSQ	Standard 25 piece bag
SGA8343ZSR	Standard 100 piece reel
SGA8343Z	Standard 1000 piece reel
SGA8343ZPCK1	800 MHz to 1000 MHz PCBA with 5-piece sample bag
SGA8343ZPCK2	1800 MHz to 2000 MHz PCBA with 5-piece sample bag
SGA8343ZPCK3	2400 MHz to 2500 MHz PCBA with 5-piece sample bag
SGA8343ZPCK4	1575 MHz PCBA with 5-piece sample bag