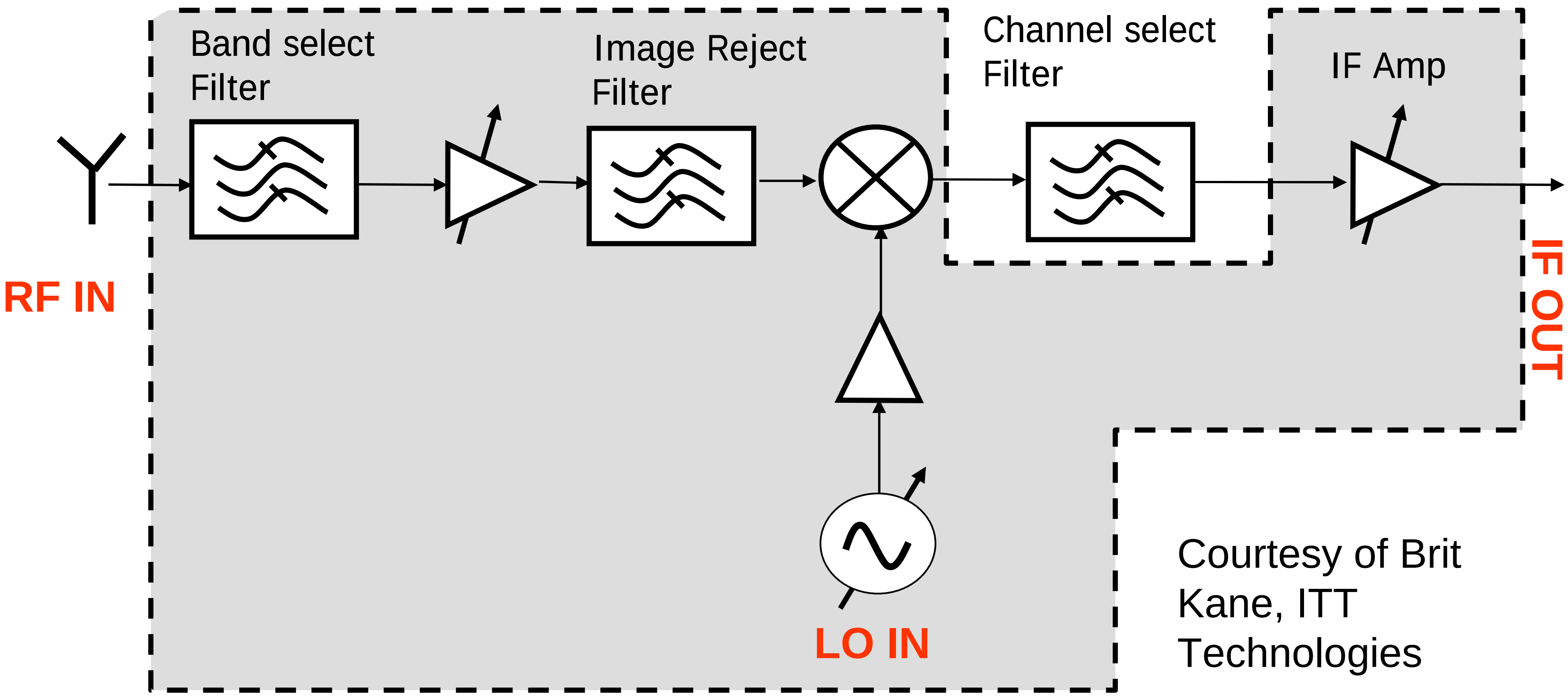
Amplifiers

muse

Amplifiers

- Overview
- Performance Parameters: Low Noise & High Power
- Design and Technology Issues
- Design Approach – Low Noise Amplifiers
- Conclusions - Impact on System Design

Overview

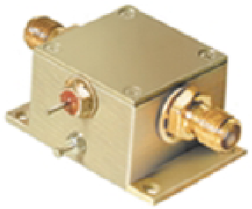


Courtesy of Brit Kane, ITT Technologies

Performance Parameters

Low Noise Amplifier ZEL-1724LN

50Ω 1700 to 2400 MHz



CASE STYLE: EEE132

Connectors	Model	Price	Qty.
SMA	ZEL-1724LN	$274.95 ea.	(1-9)

Features

- very low noise, 1.5 dB max.
- wideband, 1700 to 2400 MHz
- rugged shielded case

Applications

- PCS/DCS
- UMTS
- communication systems

Low Noise Amplifier Electrical Specifications

MODEL NO.	FREQUENCY (MHz)		NOISE FIGURE (dB)	GAIN (dB)		MAXIMUM POWER (dBm)		INTERCEPT POINT (dBm)	VSWR (:1) Max.		DC POWER	
	f_L	f_U	Max.	Min.	Flatness Max.	Output (1 dB Compr.) Typ.	Input (no damage)	IP3 Typ.	In	Out	Volt (V) Nom.	Current (mA) Max.
ZEL-1724LN	1700	2400	1.5	20	±1.0	+8	+13	+22	2.5	2.5	15	70

Noise Figure specified at room temperature, increases to 2 dB typical at +85°C

Open load is not recommended, potentially can cause damage.
With no load derate max input power by 20 dB

Maximum Ratings

Operating Temperature	-54°C to 85°C
Storage Temperature	-55°C to 100°C
DC Voltage	+17V Max.

Performance Parameters

Coaxial
Amplifier

ZHL-10W-2G+
ZHL-10W-2G

50Ω High Power 10W 800 to 2000 MHz

CASE STYLE: BT1204

Connectors	Model	Price	Qty.
SMA	ZHL-10W-2G(+)	$1295.00	(1-9)
SMA	ZHL-10W-2GX+	$1220.00	(1-9)

+ RoHS compliant in accordance with EU Directive (2002/95/EC)

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications.

Features
- high power, 10 Watt
- low current consumption, 4A typ.
- useable over 700 to 2200 MHz
- internal power regulator (current remains constant over 22 to 28V)
- no damage with an open or short output load under full CW output power

Applications
- cellular, PCN, GSM, ISM
- lab test

Electrical Specifications

MODEL NO.	FREQ. (MHz)		GAIN (dB)				MAXIMUM POWER OUTPUT (dBm)					DYNAMIC RANGE		VSWR (:1) Typ.		DC POWER**	
						Flatness	(1 dB Compr.)		(3 dB Compr.)		Input	NF (dB)	IP3 (dBm)			Volt (V)	Current (A)
	f_L	f_U	Min.	Typ.	Max.	Max.	Min.	Typ.	Min.	Typ.	(no damage)	Typ.	Typ.	In	Out	Nom.	Max.
ZHL-10W-2G(+)	800	2000	40	43	49	±2.0	+39	+40	+40	+41	+1	7.0	+50	1.3	1.3	24	5.0
ZHL-10W-2GX+*	800	2000	40	43	49	±2.0	+39	+40	+40	+41	+1	7.0	+50	1.3	1.3	24	5.0

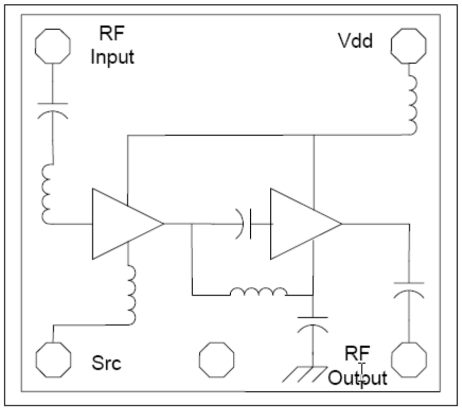
**Heat sink and fan not included*
*** Power Supply should be capable of delivering 6A at start up.*

To order without heat sink and fan, add suffix X to model number. Alternative heat sinking and heat removal must be provided by the user to limit maximum base-plate temperature to 75°C, in order to ensure proper performance. For reference, this requires thermal resistance of user's external heat sink to be 0.08°C/W Max.

Maximum Ratings

Performance Parameters

Functional Block Diagram



Selected Specifications

Parameter	min	typ	Max	units
Frequency Range	4900	-	5900	MHz
Noise Figure (with onchip match)		1.3		dB
Small Signal Gain	16.5	18		dB
Input Power (IP1dB)		-13		dBm
Input IP3		-3		dBm

Features

- 4.9 to 5.9 GHz Frequency Coverage
- Low Noise Figure
- High Gain
- Low Current: 8mA Typical @ 3V
- 50-ohm Input and Output Match
- GaAs pHEMT Technology
- Leadless 1.3 x 2.0 x 0.4 mm Lead-Free SMT Package

Applications

- 802.11a WLAN
- PCs and Mobile Devices
- WLAN Access Points
- WLAN Repeaters

Performance Parameters

TriQuint SEMICONDUCTOR

Advance Product Information

WIRELESS COMMUNICATIONS DIVISION

***Preliminary:** Subject to change without notice*

3V HBT TDMA Power Amplifier IC TQ7625

Selected Electrical Characteristics

Test Conditions: V_{CC} = +3.5 V, T_C = 25°C, V_{BIAS}=2.75V

Parameter		Min.	Typ.	Max.	Units
Usable Frequency Range		1850		1910	MHz
TDMA Output Power			28		dBm
TDMA Power Added Efficiency			40		%
ACP, Pout = +28 dBm			-30		dBc
ALT, Pout = +28 dBm			-53		dBc
Large Signal Gain			27.5		dB
Small Signal Gain (Vmode=low)			26		dB
Receive Band Noise			-92		dBm/30KHz
Quiescent Current, uses V_{mode} Switching	Vmode= low		60		mA
	Vmode= high		80		mA
V_{mode}, Externally Switched.	P_{OUT} <=+15dBm	0	0	0.3	V
	P_{OUT} =+28dBm	2.65	2.75	2.85	V
Second Harmonic, P_{OUT} =+28dBm			-45		dBc
Third Harmonic, P_{OUT} =+28dBm			-55		dBc

Primary Application(s)

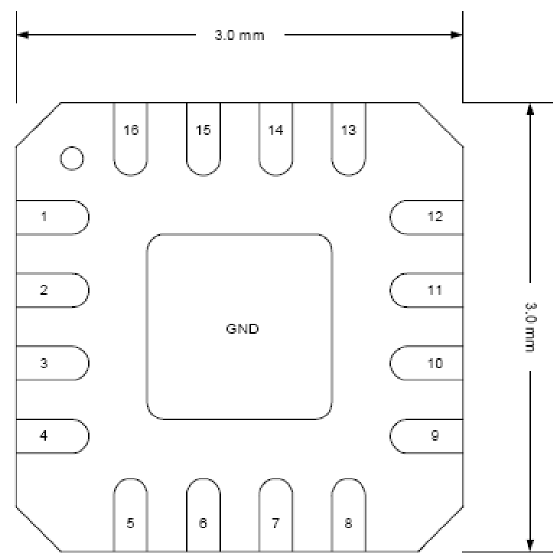
- IS-136 Mobile Phones
- Dual Band Mobile phones

Key Features

- High Efficiency
- Low Quiescent Current,
  Mode Selectable
- Small size 3x3 mm leadless packag
- Few external components
- Excellent ACP Performance
- Single +2.7V Supply

Package: 3x3 mm

Leadless 16 pin



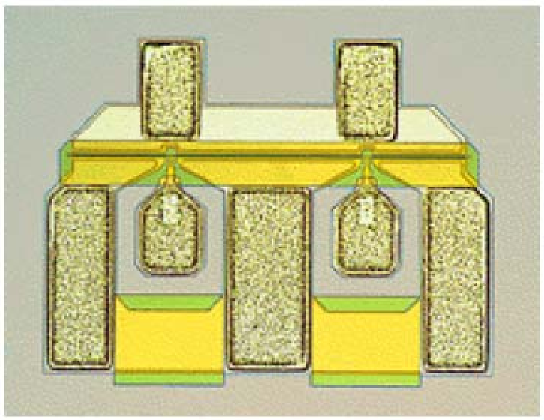
Performance Parameters

TriQuint SEMICONDUCTOR®

Product Data Sheet
February 1, 2002

Discrete MESFET

TGF1350-SCC



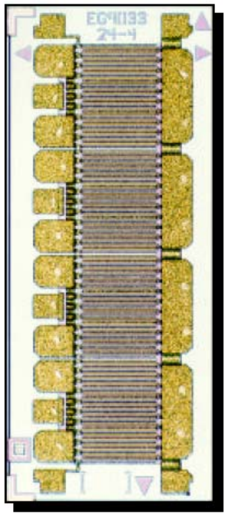
Key Features and Performance

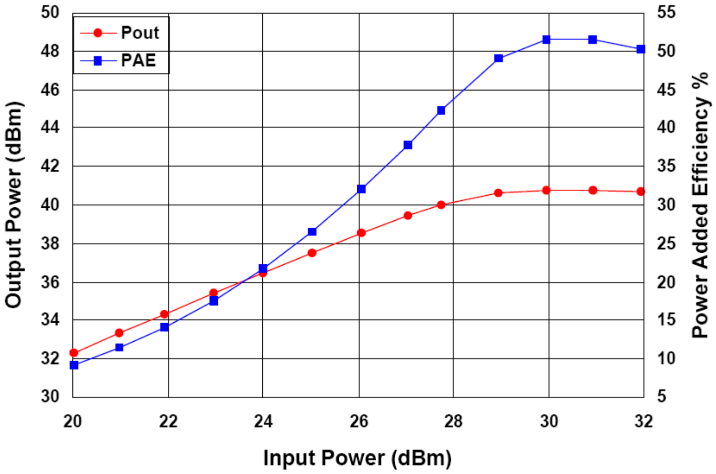
- 0.5 um x 300 um FET
- 1.5 dB Noise Figure with 11dB Associated Gain at 10 GHz
- 2.5 dB Noise Figure with 7 dB Associated Gain at 18 GHz
- All-Gold Metallization for High Reliability
- Recessed Gate Structure
- 0.620 x 0.514 x 0.102 mm (0.024 x 0.020 x 0.004 in.)

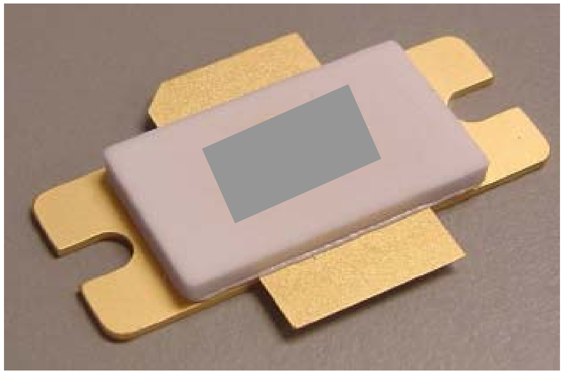
Performance Parameters

TGF4124-EPU 24 mm Discrete HFET | **4124**

- **0.5 um gate finger length**
- **Nominal Pout of 12 Watts at 2.3 GHz**
- **Nominal PAE of 51.5% at 2.3 GHz**
- **Nominal Gain of 10.8 dB at 2.3 GHz**
- **Die size 36.0 x 81.0 x 4.0 mils (0.914 x 2.057 x 0.102 mm)**



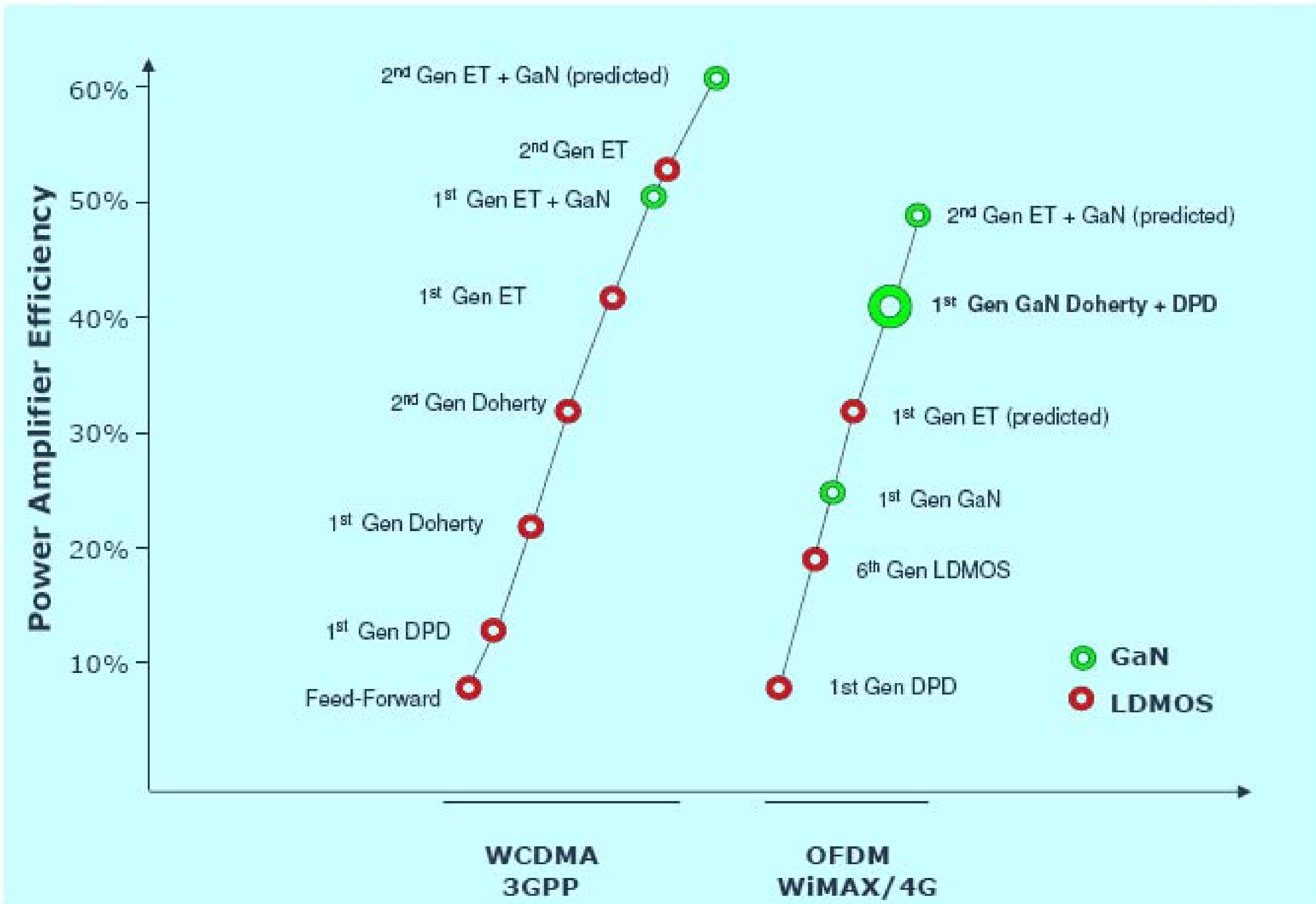




Design and Technology Issues

- Design Drivers:
  - Low noise : Noise Figure, Gain, Linearity
  - High power: Efficiency, Output Power, Bandwidth, Linearity
- Main Technologies:
  - Low Noise: CMOS (Silicon), Bi-CMOS (Silicon and Silicon-Germanium), GaAs
  - High Power: LDMOS (Silicon), MESFET (GaN and GaAs)
- (Other) Issues: Cost, Packaging (parasitics), Very Wideband Performance

Design and Technology Issues



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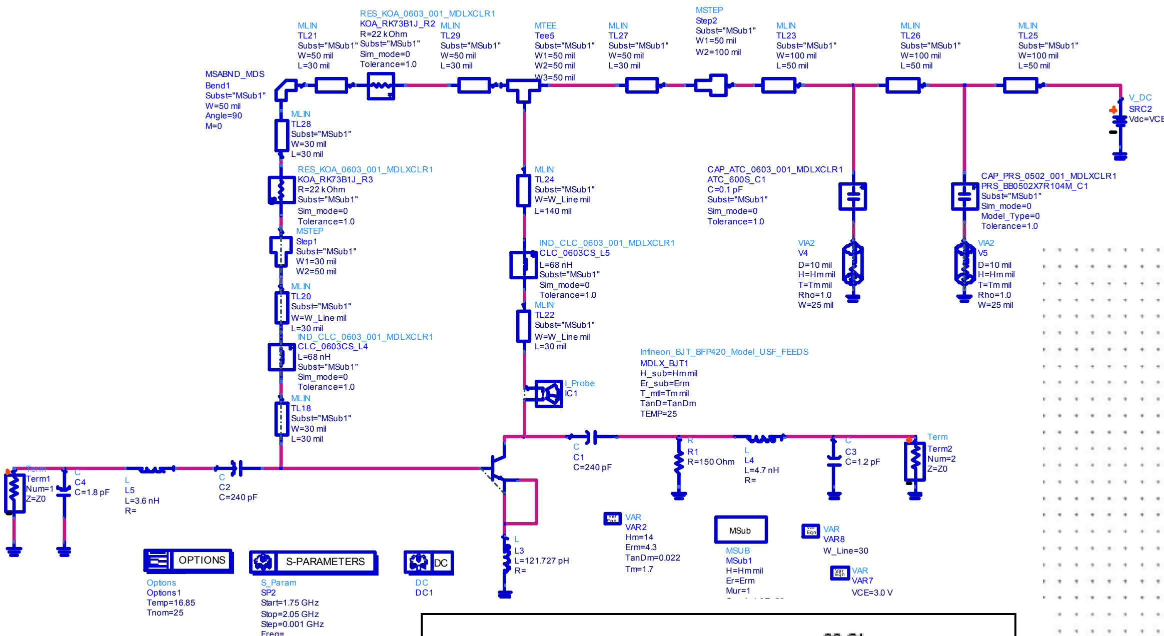
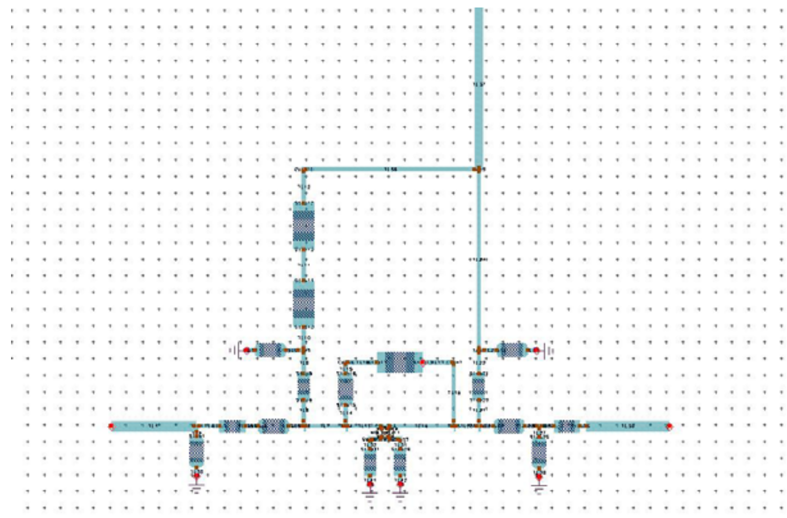
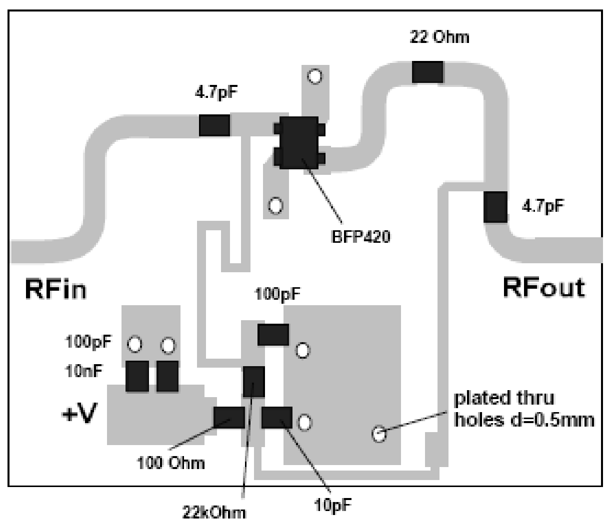
Design Approach – Low Noise Amplifiers

- The basic steps:
  - Prepare to compromise
  - Select the transistor(s) and other components
  - Find the best CAD models available for the parts
  - Select the DC operating condition
  - Design input and output impedance matching networks

Design Approach – Low Noise Amplifiers







Design Approach – Low Noise Amplifiers

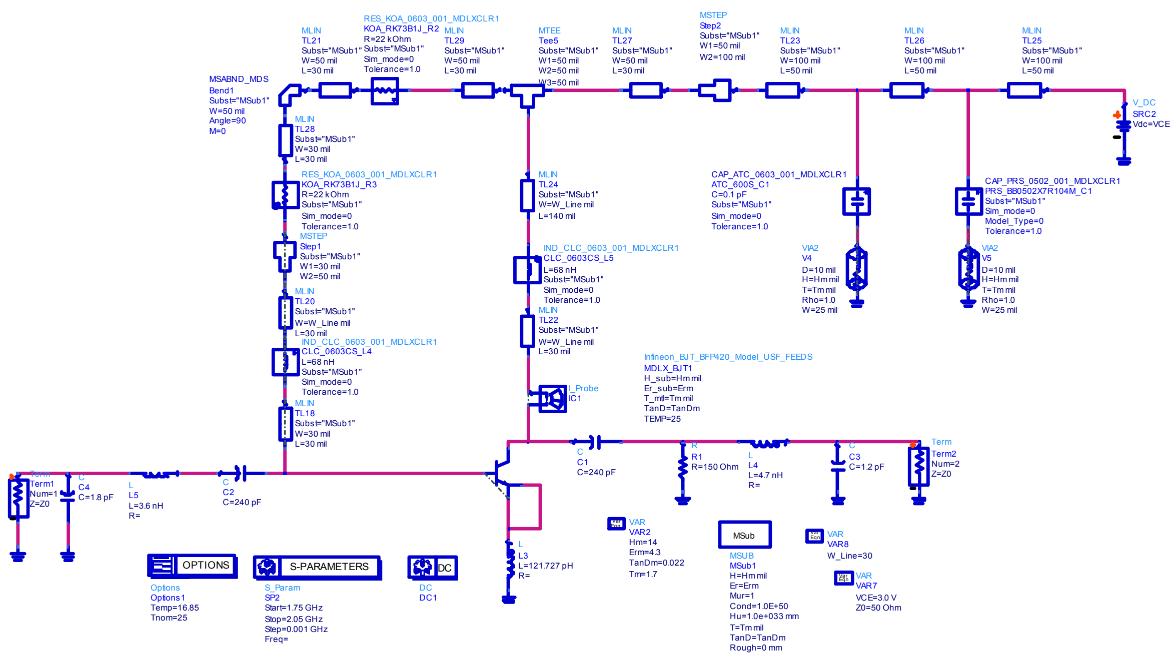
- Why compromise?

Design Approach – Low Noise Amplifiers

- Selecting the components

Design Approach – Low Noise Amplifiers

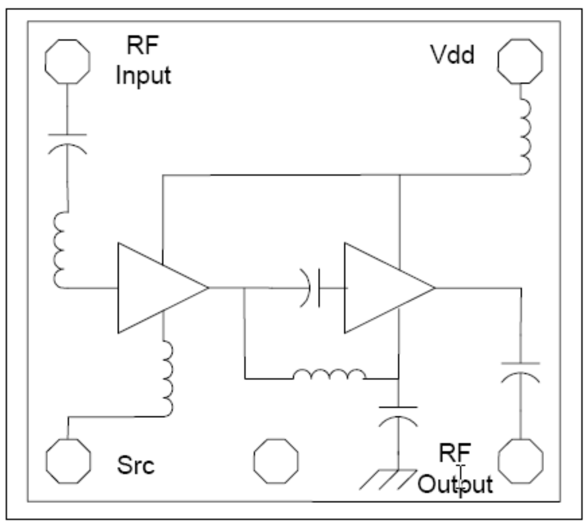
- Why are computer-aided-design (CAD) models so important?

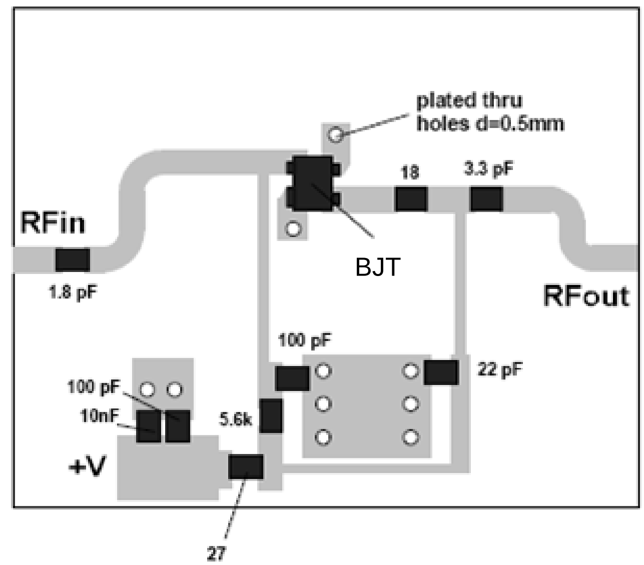


Design Approach – Low Noise Amplifiers

- DC operating condition:

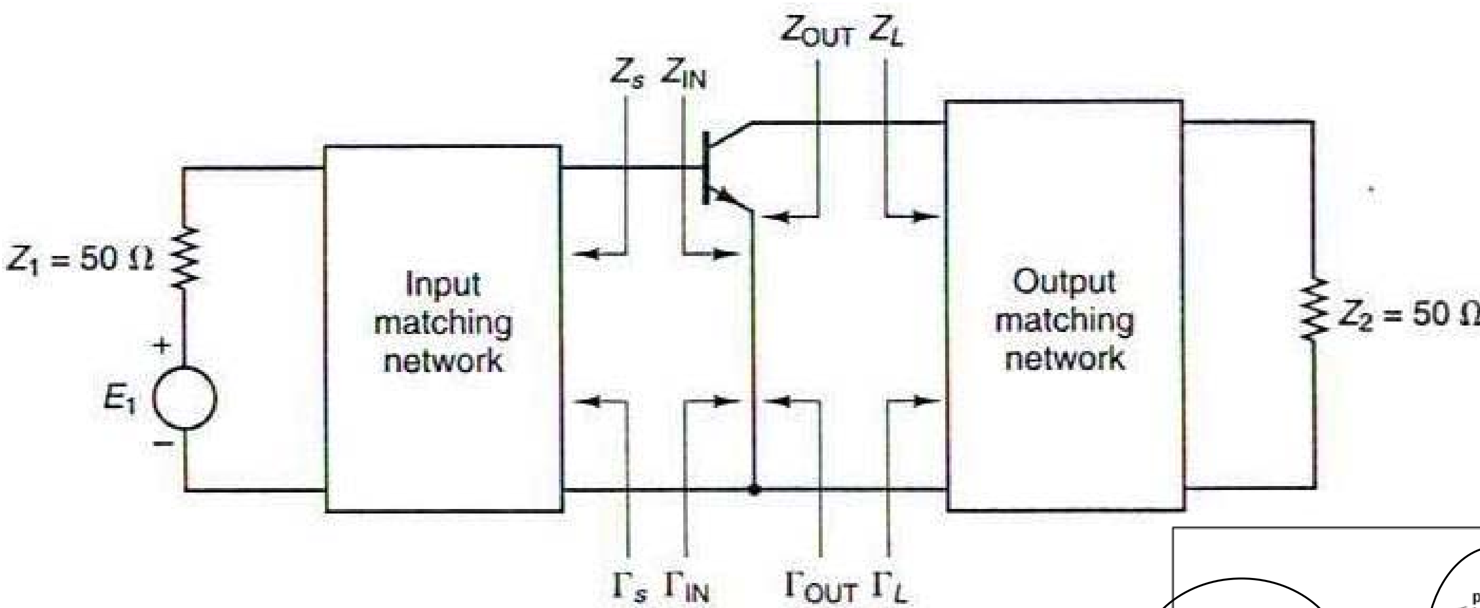
Functional Block Diagram



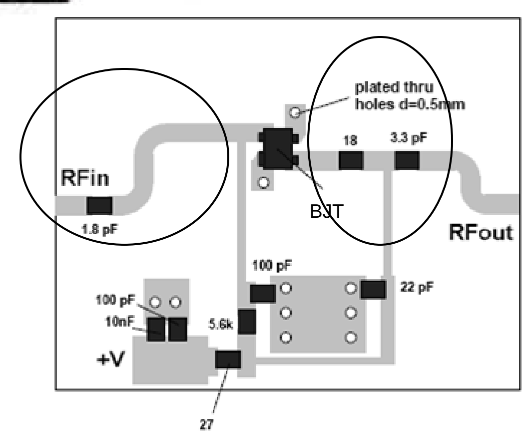


Design Approach – Low Noise Amplifiers

- Matching Networks



$$G_T = \frac{1-|\Gamma_S|^2}{|1-\Gamma_S\Gamma_{IN}|^2}|S_{21}|^2\frac{1-|\Gamma_L|^2}{|1-S_{22}\Gamma_L|^2}$$



Amplifiers – Conclusions

- System-level specifications flow down to amplifier requirements → important for system designer to understand technology options and capabilities of each
- Impact on system design
  - Range – transmit power of PA and noise figure & gain of LNA
  - Battery life – PAs are one of the biggest consumers

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