MMIC Low Noise Amplifier Portfolio

May 2013

Outline

- Markets and applications
- Portfolio information
- Femtocell reference design
- Support resources and collateral

Low Noise Amplifier Markets and Applications

- Enterprise WiFi AP and Backhaul
- Repeaters
- Wireless Applications
- Femtocell and Picocell

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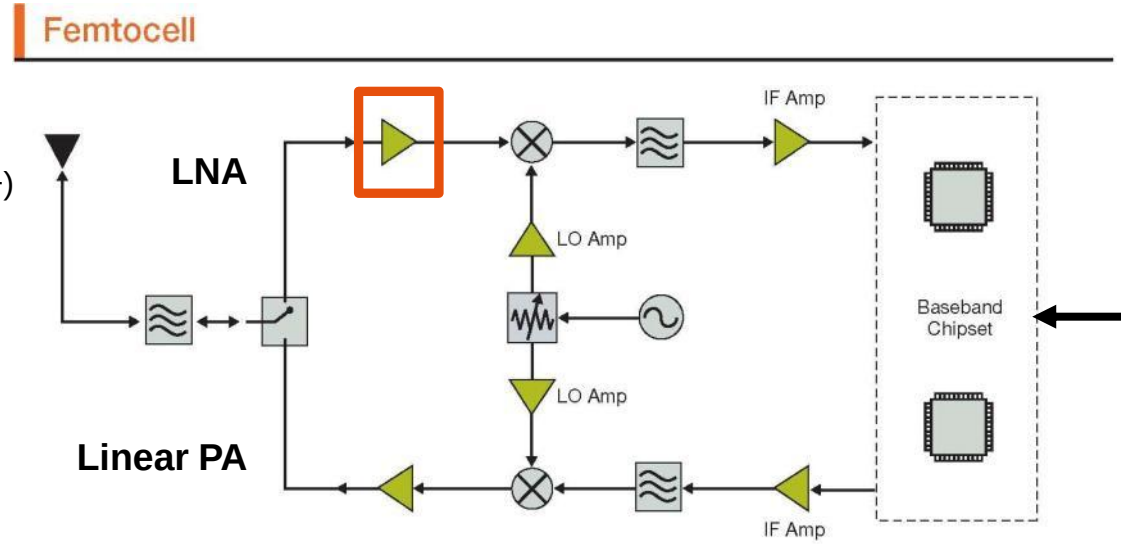
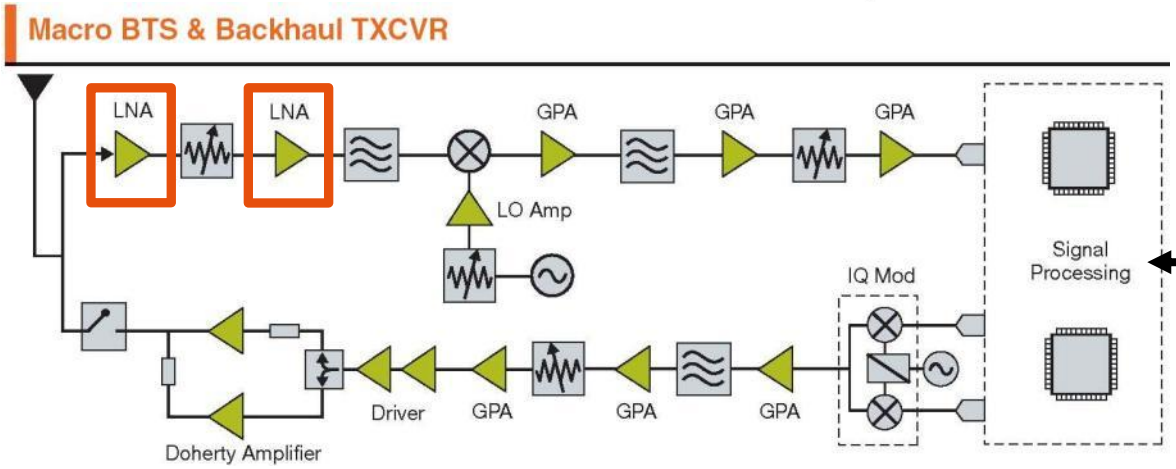
Where Do LNAs Live?

Air Interface:

- LTE FDD/TDD
- WCDMA (HSPA+)
- CDMA2K
- TD-SCDMA
- WiMAX



QorIQ Qonverge PSC9131/9132



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Low Noise Amplifier Challenges

Receiver Sensitivity

- Low noise amplification
- Sufficient gain
- Dynamic range

Multiband and multiprotocol operation with the same device

- Bandwidths exceeding 100 MHz

Consistent performance over temperature

- Flat OIP3 over temperature

Robustness

- Ability to handle input overdrive
- Class 1B to 3A ESD - HBM

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1st Gen Low Noise Amplifier Portfolio

	700 – 1000 MHz	1800 – 2200 MHz	2300 – 2700 MHz
Single Stage	Single Stage: MML09211H NF = 0.52 dB Gain = 21.3 dB P1dB = 22 dBm OIP3 = 32.6 dBm	Single Stage: MML20211H NF = 0.65 dB Gain = 18.6 dB P1dB = 21.3 dBm OIP3 = 33 dBm	Single Stage: MML20211H NF = 0.85 dB Gain = 18.1 dB P1dB = 19.6 dBm OIP3 = 33 dBm
Dual stage	Dual Stage: MML09212H NF = 0.52 dB Gain = 37.5 dB P1dB = 22.8 dBm OIP3 = 37 dBm	Dual Stage: MML20242H NF = 0.57 dB Gain = 34 dB P1dB = 24 dBm OIP3 = 39.5 dBm	Dual Stage: MML20242H NF = 0.85 dB Gain = 32 dB P1dB = 24 dBm OIP3 = 39.5 dBm

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2nd Gen – MML09231H

700 – 1000 MHz

Single Stage

Single Stage:

MML09231H

NF = 0.36 dB

Gain = 17.2 dB

P1dB = 24.5 dBm

OIP3 = 37.4 dBm

Note: 2nd generation 2000 and 2500 MHZ LNAs available in late 2013

Low Noise Amplifier Product Selector Guide

Applications

- GSM, LTE, W-CDMA, TD-SCDMA, CDMA base station receivers
- Smart energy (IEEE® 802.15.4 ZigBee®)
- Small cell receivers
- Automotive
- GPS
- WLAN
- Two-way radio

The Freescale low noise amplifier (LNA) portfolio offers solutions to meet future design needs in a wide range of applications. Two technologies serve the LNA portfolio, each with distinct advantages for their applications. Our new GaAs E-pHEMT LNAs serve wireless infrastructure, small cell base station and many general wireless applications. Advanced SiGe technology is utilized in LNAs designed for wireless communication, cellular, consumer, automotive and industrial applications. Combining high performance with unique features and application-specific design tools, Freescale LNAs enable new design opportunities and shorten the design cycle.

GaAs LNA

Part Number	Freq. Range (MHz)	Test Freq. (MHz)	Small Signal Gain (dB)	Noise Figure (dB)	P1dB (dBm)	OIP3 (dBm)	Supply Voltage (V)	Supply Current (mA)	Package
MML20211H	1400–2800	2140	18.6	0.65	21.3	33	5	60	DFN 2 x 2
MML09211H	400–1400	900	21.3	0.52	22	32.6	5	60	DFN 2 x 2
MML09212H	400–1400	900	37.5	0.52	22.8	37	5	150	QFN 3 x 3
MML20242H	1400–2800	2140	34	0.57	24	39.5	5	160	QFN 3 x 3
MMG15241H	500–2800	2600	14.4	1.3	24	40.6	5	85	SOT-89
MML09231H	700–1400	900	17.2	0.36	24.5	37.4	5	55	DFN 2 x 2
MMG20271H	1500–2700	2140	16	1.7	27.5	42	5	180*	QFN 3 x 3
MMG20271H9	1500–2700	2140	16	1.7	27.5	43.1	5	215	SOT-89

* Nominal supply current is fully adjustable

SiGe LNA

Part Number	Freq. Range (MHz)	Test Freq. (MHz)	Gain (dB)	Noise Figure (dB)	P1dB (dBm)	OIP3 (dBm)	Supply Voltage (V)	Supply Current (mA)	Package
MBC13720	400–2500	900	20	1.2	11.5	22	2.3–3	5,11	SOT-363
MBC13916	100–2500	900	19	1.25	2.5	11	2.7–5	4.7	SOT-343R
MBC13917	100–2500	434	27	2.3	2.2	10.9	2.1–3.3	4.7	MLPD-6
MC13850	400–2500	1960	15	1.75	4	24.6	2.3–3	9.9, 4.7	MLPD-8
MC13851	1000–2500	1960	18	1.35	8	17.1	2.3–3	3.8	MLPD-8
MC13852	400–2500	900	18.2	1.2	9.9	13.1	2.3–3	4.4	MLPD-8

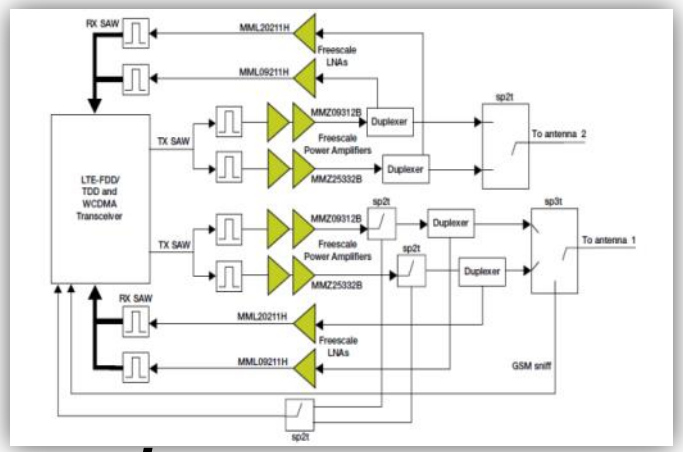
Freescale Femtocell Reference Design

- FDD LTE & WCDMA
- Band 1 & 13
- 20 mW average power at antenna

PSC9131 RDB

Dual Band Radio Board(s)

Baseband to Antenna Reference Design



Freescale Low Noise Amplifiers: Features and Competitive Advantages

Features

- Excellent Noise Figures (0.36 – 0.85 dB)
- Unconditionally stable over temperature
- Single +5 V supply; adjustable bias
- Performance insensitive to temperature
- Trade-offs between gain, NF and IP3 performance are greatly eased
- Inputs tolerant of +20 dBm overdrive
- Very high reverse isolation

Competitive Advantages

- Long established reputation for quality
- Unconditional stability over temperature
- Superior ESD handling and overdrive capability
- Simplified solutions: minimal BOM
- High reliability: proven by intrinsic and extrinsic reliability test data for every product
- Secure supply chain
- World-class global sales and application support
- GaAs E-pHEMT: excellent linearity with the lowest NF
- Single and dual-stage designs

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MMIC Designer Kit and Solutions Binder

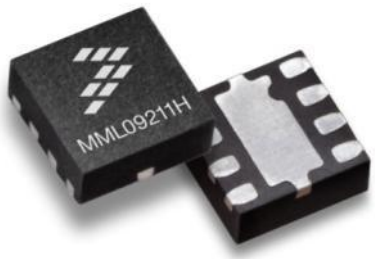
5 loose samples of each device in anti-static canisters

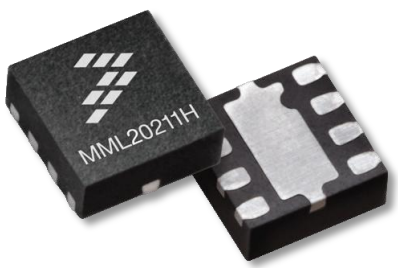
Designer Kit and GaAs Solutions Binder are available online at freescale.com/RFMMIC

Support Resources

- Data Sheets and Application Notes: freescale.com/RFMMIC
- S-Parameters: freescale.com/RFMMIC > Design Support
- Solutions Brochure: freescale.com/files/rf_if/doc/brochure/BR1609.pdf
- Cross Reference: freescale.com/files/rf_if/doc/quick_ref_guide/MMICGPAQRG.pdf
- Samples and Kits: freescale.com/RFMMIC

For more information on our MMIC portfolio, visit our website at freescale.com/RFMMIC





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