Data Sheet April 1999 File Number 4242.3

2.7GHz UpConverter with Gain Control

INTERSIL PRISM™ WLAN CHIP SET

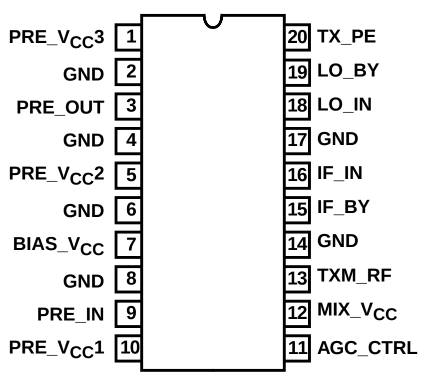
The HFA3664 UpConverter with Gain Control is a monolithic bipolar PRISM® device for up conversion applications in the 2.3GHz to 2.7GHz range. Manufactured in the Intersil UHF1X process, the device consists of a double balanced mixer followed by a variable gain power preamp. An energy saving, TTL Compatible, power enable input provides on/off bias current control to the mixer and amplifier. The device requires low drive levels from the local oscillator and is housed in a small outline 20 lead SSOP package ideally suited for PCMCIA card applications.

Ordering Information

PART NUMBER	TEMP. RANGE (^oC)	PACKAGE	PKG. NO.
HFA3664IA	-40 to 85	20 Ld SSOP	M20.15
HFA3664IA96	-40 to 85	Tape and Reel	

Pinout

HFA3664
(SSOP)
TOP VIEW



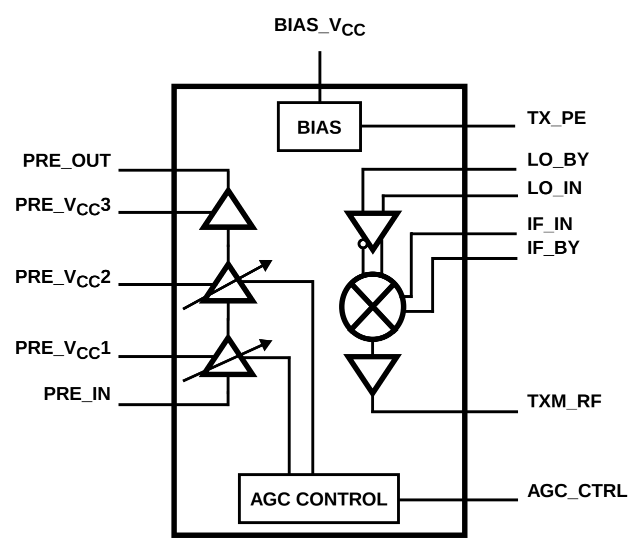
Features

- RF Frequency Range . . . . 2.3GHz to 2.7GHz
- IF Operation . . . . .10MHz to 400MHz
- Gain Control Range 20dB
- Single Supply Operation. . . . . .2.7V to 5.5V
- High Output 1dB Compression. 6dBm
- High Power Gain 18dB
- Power Enable/Disable Control

Applications

- Wireless Local Loop Systems
- PCMCIA Wireless Transceiver
- Wireless Local Area Network Modems
- CDMA/TDMA Packet Protocol Radios
- Full Duplex Transceivers
- Portable Battery Powered Equipment

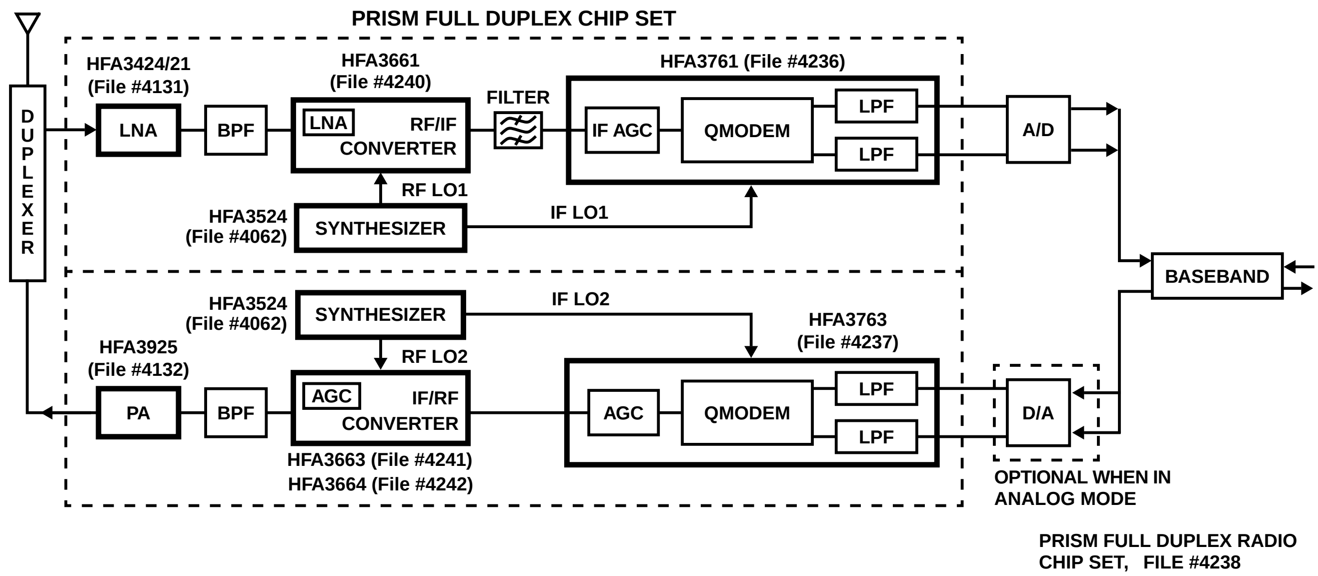
Block Diagram



POWER CONTROL TRUTH TABLE

STATE	TX_PE
Power Down - Energy Saving Mode	Low
Transmit Mode	High

Typical Application Diagram



Pin Descriptions

NAME	DESCRIPTION
LO_IN	Local Oscillator Input.
LO_BY	Local Oscillator Input Bypass (AC coupled to GND).
PRE_IN	Power Pre-Amplifier Input.
PRE_OUT	Power Pre-Amplifier Output.
PRE_V_{CC}1	Power Pre-Amplifier 1st Stage Positive Power Supply. Use high quality RF decoupling capacitors.
PRE_V_{CC}2	Power Pre-Amplifier 2nd Stage Positive Power Supply. Use high quality RF decoupling capacitors.
PRE_V_{CC}3	Power Pre-Amplifier 3rd Stage Positive Power Supply. Use high quality RF decoupling capacitors.
BIAS_V_{CC}	LO Buffer, Bias, Mixer and AGC Control Positive Power Supply. Requires an isolation coil to V_{CC}.
MIX_V_{CC}	Transmit Mixer Output Stage Positive Power Supply. Use high quality RF decoupling capacitors.
RX_PE	Power Enable Control Input. Refer to the Power Control Truth Table.
TXM_RF	Transmit Mixer RF Output.
IF_IN	Transmit Mixer Positive IF Input. Requires external bias resistor to V_{CC}.
IF_BY	Transmit Mixer Negative IF Input (AC coupled to GND).
GND	Circuit Ground Pins (Qty 6). Internally connected with the exception of pin 17.

Absolute Maximum Ratings

Supply Voltage . . . . -0.3 to 6.0V
Voltage on Any Other Pin. -0.3 to V_{CC} 0.3V

Operating Conditions

Supply Voltage Range . . . . .2.7V to 5.5V

Thermal Information

Thermal Resistance (Typical, Note 1) θ_{JA} (^{o}C/W)
20 Lead SSOP 110
Package Power Dissipation at 70^{o}C
20 Lead SSOP 0.7W
Maximum Junction Temperature (Plastic Package) . . . . .150^{o}C
Maximum Temperature Range. . . . . -40^{o}C $\le T_A \le$ 85^{o}C
Maximum Storage Temperature Range . . . . -65^{o}C $\le T_A \le$ 150^{o}C
Maximum Lead Temperature (Soldering 10s) . . . . 300^{o}C
(Lead Tips Only)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications

V_{CC} = 5.5V, LO = 2400MHz, IF = 100MHz, RF = 2500MHz, Z_O = 50W, Unless Otherwise Specified

PARAMETER		SYMBOL	(NOTE 2) TEST LEVEL	TEMP (^{o}C)	MIN	TYP	MAX	UNITS
CASCADED CHARACTERISTICS (-3dB Loss RF Image Filter with 35dB LO Suppression, LO_IN = 2400MHz/-6dBm, IF_IN = 100MHz/-30dBm, AGC_CTRL = 0.7V (Max Gain))								
Cascaded Output 1dB Compression		CTX_P1D	B	25	6	7.5	-	dBm
Cascaded Output Third Order Intercept		CTX_IP3	C	25	-	14	-	dBm
Cascaded Power Gain		CTX_PG	B	25	18	23	-	dB
Cascaded Power Gain Flatness (2.3GHz to 2.7GHz)		CTX_PGF	C	25	-2.5	0	+2.5	dB
Cascaded LO Leakage		CTX_LEAK	B	25	-	-23.8	-	dBm
LO INPUT CHARACTERISTICS (LO_IN = 2400MHz/-6dBm, all unused inputs and outputs are terminated into 50Ω)								
LO Input Frequency Range		LO_f	B	25	1.9	-	2.29	GHz
LO Input Drive Level		LO_dr	A	25, 85	-	-6	-	dBm
LO Input VSWR		LO_SWR	A	25, 85	1.0:1	1.62:1	2.3:1	-
LO Input Return Loss		LO_IRL	A	25, 85	8.09	12.5	-	dB
TRANSMIT MIXER CHARACTERISTICS (LO_IN = 2400MHz/-6dBm, TXM_IF = 100MHz/-30dBm)								
IF Input Frequency Range		TXM_IFf	B	25, 85	10	-	400	MHz
IF Input VSWR		TXM_SWR	A	25, 85	-	1.22:1	2.0:1	-
IF Input Return Loss		TXM_IRL	A	25, 85	9.5	20	-	dB
Power Conversion Gain (Note 3)	V_{CC} = 5.5V	TXM_PGH	A	25, 85	3.0	4.5	TBD	dB
Transmit Mixer LO Leakage		TXM_LEAK	A	25, 85	-	-20	-10	dBm
RF Output Frequency Range		TXM_RFf	B	25, 85	2.4	-	2.7	GHz
RF Output VSWR		TXM_OSWR	A	25, 85	1.01	1.68:1	2.3:1	-
RF Output Return Loss		TXM_ORL	A	25, 85	8.09	12	-	dB
RF Output 1dB Compression (Note 3)	V_{CC} = 5.5V	TXM_P1DH	A	25, 85	-10	-7.5	-	dBm
RF Output Third Order Intercept		TXM_IP3	C	25	-	-1.0	-	dBm
Transmit Mixer Noise Figure		TXM_NF	B	25	-	18	-	dB

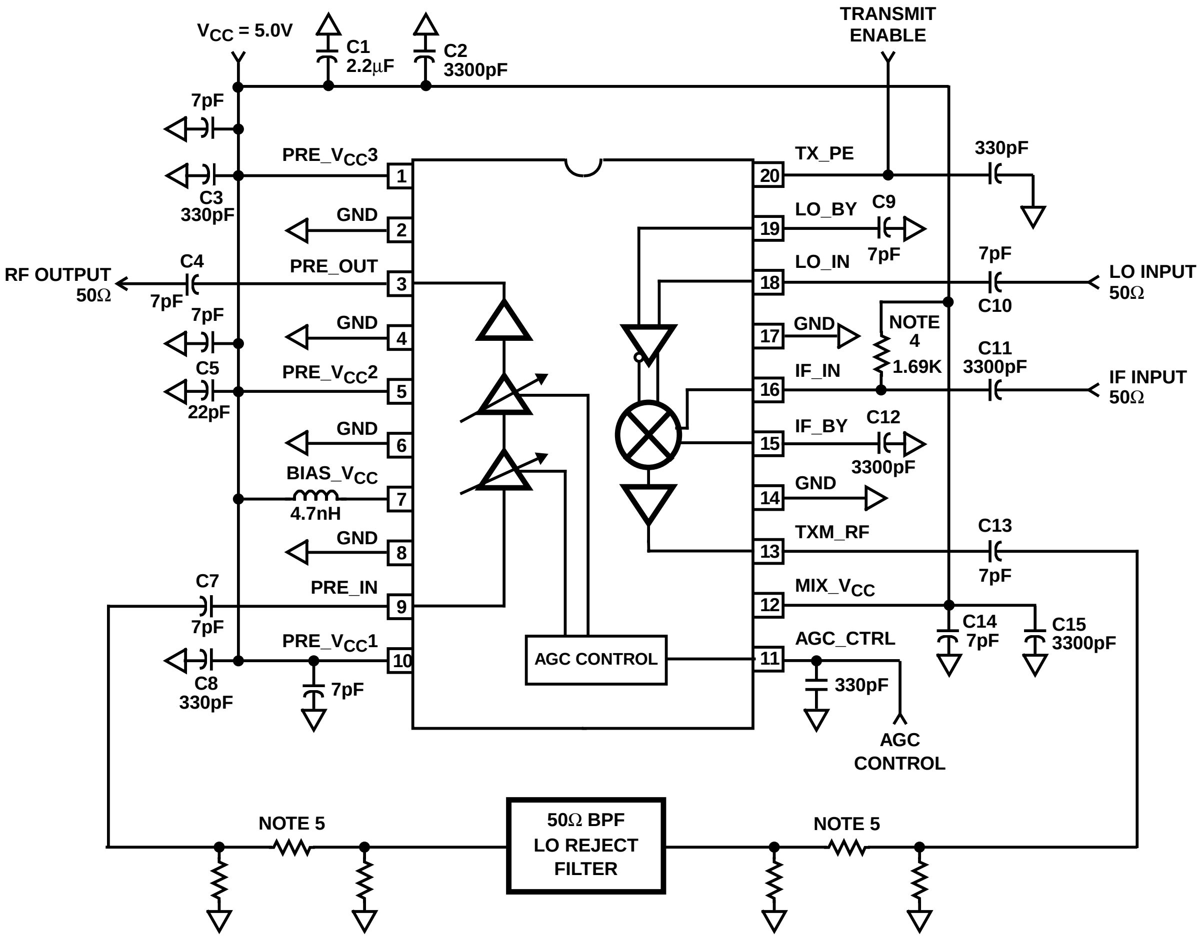
Electrical Specifications V_{CC} = 5.5V, LO = 2400MHz, IF = 100MHz, RF = 2500MHz, Z_O = 50W, Unless Otherwise Specified **(Continued)**

PARAMETER		SYMBOL	(NOTE 2) TEST LEVEL	TEMP (^oC)	MIN	TYP	MAX	UNITS
TRANSMIT POWER PREAMP CHARACTERISTICS (PRE_IN = 2400MHz/-30dBm, AGC_CTRL = 0.7V (Max Gain))								
Frequency Range		PRE_f	B	25	2.3	-	2.7	GHz
Power Gain (AGC_CTRL = 0.7V)	V_{CC} = 5.5V	PRE_PGH	A	25, 85	21	24	27	dB
Pre-Amp Noise Figure (Max Gain)		PRE_NF	B	25	-	8	-	dB
Pre-Amp AGC Range (Max - Min Gain)		PRE_AGC	A	25, 85	20	30	-	dB
AGC Control Voltage Range		AGC_V	A	25, 85	0.7	-	1.7	V
AGC Control Linearity		AGC_LIN	B	25	-	5:1	-	-
AGC Settling Time (Min to Max Gain)		AGC_T1	B	25	-	8.0	-	µS
AGC Settling Time (Max to Min Gain)		AGC_T2	B	25	-	0.1	-	µS
Pre-Amp RF Output 1dB Compression	V_{CC} = 5.5V	PRE_P1DH	A	25, 85	6	8	-	dBm
RF Output Third Order Intercept		PRE_IP3	C	25	-	14	-	dBm
Input VSWR		PRE_ISWR	A	25, 85	1.0:1	2.0:1	3.0:1	-
Input Return Loss		PRE_IRL	A	25, 85	6	7	-	dB
Output VSWR		PRE_OSWR	A	25, 85	1.0:1	1.28:1	2.3:1	-
Output Return Loss		PRE_ORL	A	25, 85	8.09	20	-	dB
POWER SUPPLY AND LOGIC CHARACTERISTICS								
Voltage Supply Range		V_{CC}	A	25, 85	-	5.5	-	V
Supply Current (V_{CC} = 5.5V)		$I_{CC\ HI}$	A	25, 85	90	103	110	mA
		$I_{CC\ HI}T$	C	Full	-	-	110	mA
Power Down Supply Current (V_{CC} = 5.5V)		I_{CC}_PD	A	25, 85	2	3.3	4	mA
Logic Input Low Level		V_{IL}	A	25, 85	-0.2	-	0.8	V
Logic Input High Level		V_{IH}	A	25, 85	2.0	-	V_{CC}	V
Logic Low Input Bias Current (V_{PE} = 0V, V_{CC} = 5.5V)		I_B_LO	A	25, 85	-5	-0.1	5	µA
Logic High Input Bias Current (V_{PE} = 5.5V, V_{CC} = 5.5V)		I_B_HI	A	25, 85	-5	0.6	5	µA
Vagc High Input Bias Current (Vagc = 2.1V, V_{CC} = 5.5V)		Ivagc_HI	A	25, 85	10	200	400	µA
Vagc Low Input Bias Current (Vagc = 0.7V, V_{CC} = 5.5V)		Ivagc_LO	A	25, 85	-400	-235	-10	µA
Power Enable Time (50% V_{PE} to 90% I_{CC})		PEt	B	25	-	5	10	µs
Power Disable Time (50% V_{PE} to 10% I_{CC})		PDt	B	25	-	0.1	10	µs

NOTES:

2. Test Level: A = 100% production tested, B = Typical or Limit based on characterization data, C = Design information, goal or condition.
3. Bias Resistor at pin 16 changes according to the relationship mentioned in Note 4 of the Typical Applications Circuit.

Typical Application Circuit



NOTES:

4. Required external resistor for Mixer biasing. Value optimized for 2.7mA bias current with R = (V_{CC} - 0.93) /2.7mA. Most Mixer cell characteristics like Gain, NF etc., can be affected when biasing is outside the optimum value.
5. The combination of these attenuator pads and the Band Pass Filter insertion loss shall bring the overall Cascaded Gain at the desired frequency of operation from 21dB to 22dB for best performance. The selection of these values is optional. The total gain, LO feedthru, Mixer and Pre-amplifier interaction (stability) and output compression point performances can be manipulated according to the user needs.