guide

HEWLETT PACKARD
Expanding Possibilities

HP Wireless Communications Products, Markets

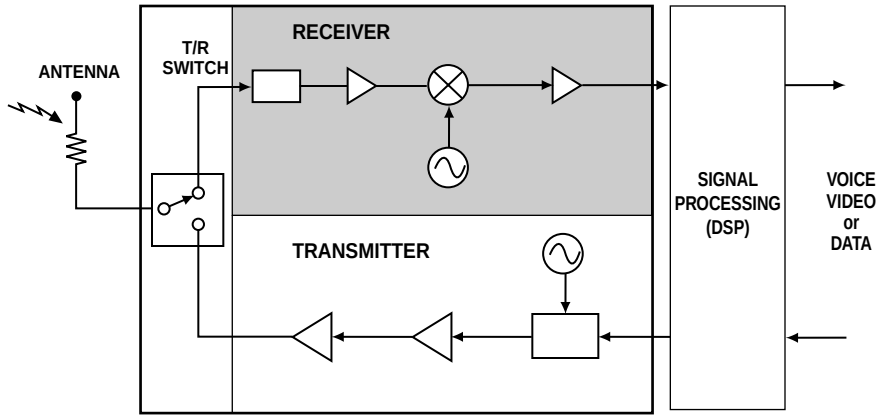
Part-to-Market *Quick* Guide, Version 4.0

Table of Contents

Abbreviations of Wireless Terms

CATV	Cable Television (50 to 300 MHz)
DBS	Direct Broadcast Satellite (12 GHz)
DSP	Digital Signal Processor (baseband)
DSS	Digital Satellite Service (12 GHz)
GaAs FET	Gallium Arsenide Field Effect Transistor
GPS	Global Positioning System (1.5 GHz)
IF	Intermediate Frequency
IP_3	Third Order Intercept Point
ISM	Industrial-Scientific-Medical bands (e.g., 900 MHz; 2.4, 5.8 GHz)
LAN	Local Area Network
MMDS	Multipoint Microwave Distribution System – “Wireless Cable” (2.5 – 2.7 GHz)
MMIC	Monolithic Microwave Integrated Circuit
NF	Noise Figure
P_{1dB}	Power level at 1.0 dB of gain compression
PCS	Personal Communications Services (1.9 GHz)
PCN	Personal Communications Network (DCS–1800 MHz)
PLL	Phase-Locked Loop
RF	Radio Frequency
RF/DC	RF Data Communication
RF/ID	RF Identification
RFIC	Radio Frequency Integrated Circuit
SMR	Specialized Mobile Radio (150, 450, 900 MHz)
T/R	Transmit/Receive
TSS	Tangential Signal Sensitivity
TVRO	Television Receive Only (3.7 – 4.2 GHz)
VSAT	Very Small Aperture Terminal (12 GHz)

Receivers

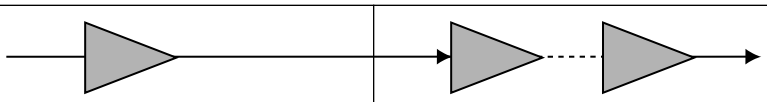


Input Protection

Name	**Limiter**
Symbol	
Function	Protects the receiver from damage by high power input signals
Key Parameters **Typical Markets**	Loss (dB) - lower is better Power leakage (in dBm) - lower is better For PIN diodes, **Series Resistance, Rs** (ohms) - lower is better
RF up to **900 MHz** • Cellular & cordless telephones • 900 MHz ISM band Wireless Data RF Tags & RF/ID Wireless modems • Mobile Radio (SMR) • CATV • Pagers/messaging	**PIN Diode** HSMP-382x
RF up to **2.5 GHz** • GPS (1.5 GHz) • 2.4 GHz ISM band Wireless Data RF Tags & RF/ID Wireless modems • PCS (1.8 GHz) • MMDS (2 GHz)	**PIN Diode** HSMP-482x
RF up to **6 GHz** • 5.8 GHz ISM band Wireless Data RF Tags & RF/ID	**PIN Diode** HSMP-482x

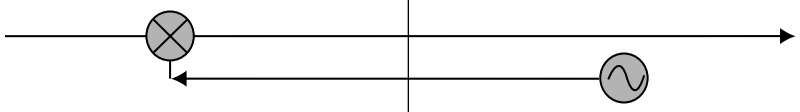
Receivers

RF Amplifier

Name	**Low Noise Amplifier (LNA)**	
	1st Gain Stage	**2nd, 3rd, … Gain Stages**
Symbol		
Function	Increase level of very small signals	Increase signal level
Key Parameters **Typical Markets**	**NF** (dB) - lower is better **Gain** (dB) - higher is better **Input IP$_3$** (dBm) - higher is better Also, Operating voltage, Frequency range, Operating current	**Gain** (dB) - higher is better **P$_{1dB}$ power** (dBm) - higher is better **NF** (dB) - lower is better Also, Operating voltage, Frequency range, Operating current
RF up to **900 MHz** • Cellular & cordless telephones • 900 MHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • Mobile Radio (SMR) • CATV • Pagers/messaging	**Silicon RFIC** INA series (low NF, high Gain) MSA series (moderate NF, higher P1dB, low $) **Silicon Bipolar Transistor** AT-415xx (low NF, easy to use) AT-305xx, 310xx, 320xx (low NF, low bias) HBFP-04xx (high Gain, low bias) **GaAs FET** ATF-10236, ATF-21186 (lower NF)	**Silicon RFIC** INA series (low NF, high Gain) MSA series (moderate NF, higher P1dB, low $) **Silicon Bipolar Transistor** AT-415xx (low NF, easy to use) AT-305xx, 310xx, 320xxx (low bias)
RF up to **2.5 GHz** • GPS (1.5 GHz) • 2.4 GHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • PCS (1.8 GHz) • MMDS (2 GHz)	**Discrete Transistor** AT-415xx (low NF) AT-305xx, 310xx, 320xx (low bias) ATF-10236 (lower NF) HBFP-04xx (low NF, high Gain) **Silicon RFIC** INA series (low NF, high Gain) **GaAs FET** ATF-10xxx ATF-21xxx **GaAs RFIC** MGA-855xx, MGA-865xx, MGA-87563 (3-volt) HPMX-3003 (LNA, Switch, PA)	**Discrete Transistor** AT-415xx (low NF) AT-305xx, 310xx, 320xx (low bias) HBFP-04xx (low NF, high Gain) **Silicon RFIC** INA series (low NF, high Gain) MSA series (moderate NF, low $) **GaAs RFIC** MGA-865xx; MGA-87563 (3-volt)
RF up to **6 GHz** • 5.8 GHz ISM band Wireless Data RF Tag & RF/ID Reader • TVRO (4 GHz)	**Discrete Transistor** HBFP-04xx (low NF, high Gain) **GaAs RFIC** MGA-855xx, MGA-865xx, MGA-875xx	**Discrete Transistor** HBFP-04xx (low NF, high Gain) **GaAs RFIC** MGA-81563, MGA-82563
	GaAs FET ATF-10xxx (low NF) ATF-36xxx series (PHEMT - lowest NF)	
RF up to **18 GHz** • DBS/DSS (12 GHz) • VSAT (12 GHz)	**GaAs FET** ATF-36xxx series (PHEMT - lowest NF)	

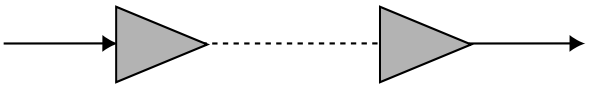
Receivers

Frequency Conversion

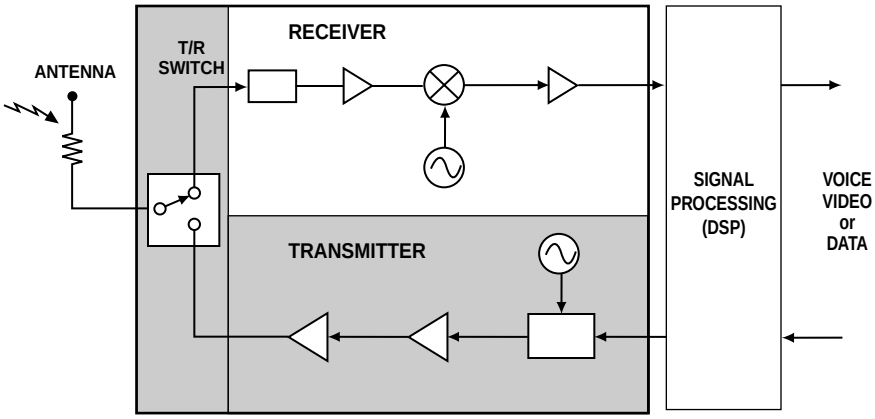
Name	**Mixer**	**Local Oscillator (LO)**
Symbol		
Function	Convert incoming RF to lower frequency	Provide signal required by mixer
Key Parameters / **Typical Markets**	1. Active Mixers (RFIC or transistor): **NF** (dB) - lower is better **Conversion Gain** (dB) - higher is better **Input IP$_3$** (dBm) - higher is better 2. Schottky Diodes (for passive mixers): **C_T** (pF) - depends on frequency **R_S** (ohms) - lower is better Also, Operating voltage, Frequency range, Operating current	**P_{1dB} Output Power** (dBm) - higher is better **Silicon** products are better than GaAs for Local Oscillators (lower phase noise) Also, Operating voltage, Frequency range, Operating current
RF up to **900 MHz** • Cellular & cordless telephones • 900 MHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • Mobile Radio (SMR) • CATV • Pagers/messaging	**RFIC Mixers** IAM series **Schottky Diodes** HSMS-282x **Silicon Bipolar Transistor** (as a mixer) AT-305xx, 310xx, 320xx (low bias) HBFP-04xx	**Silicon Bipolar Transistor** AT-414xx, 415xx, 420xx AT-305xx, 310xx, 320xx (low bias) HBFP-04xx
RF up to **2.5 GHz** • GPS (1.5 GHz) • 2.4 GHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • PCS (1.8 GHz) • MMDS (2 GHz)	**Silicon RFIC Up/Down Converter** HPMX-5001 (1.5-2.5 GHz) **RFIC Mixers** IAM series **Schottky Diodes** HSMS-282x, 8101, 820x **Silicon Bipolar Transistor** (as a mixer) AT-305xx, 310xx, 320xx (low bias) HBFP-04xx	**CMOS Frequency Synthesizer:** HPLL-8001 (for use with HPMX-5001)
RF up to **6 GHz** • 5.8 GHz ISM band Wireless Data RF Tag & RF/ID Reader • TVRO (4 GHz)	**Silicon Bipolar Transistor** HBFP-04xx **RFIC Mixers** IAM-9xxxx (to 5 GHz) **Schottky Diodes** HSMS-8101, 820x **GaAs FET** (as a mixer) ATF-10xxx, ATF-13xxx	**Silicon Bipolar Transistor** AT-414xx, 415xx, 420xx AT-305xx, 310xx, 320xx (low bias) HBFP-04xx **GaAs FET** ATF-13xxx
RF up to **18 GHz** • DBS/DSS (12 GHz) • VSAT (12 GHz)	**Discretes** HSMS-8xxx (to 12 GHz) HSCH-53xx HSCH-9xxx (to mmwave) ATF-13xxx (GaAs FET mixer) ATF-36xxx	**GaAs FET** ATF-13xxx ATF-36xxx

Receivers

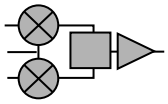
IF Amplifier

Name	**Intermediate Frequency (IF) Amplifier** **1st Gain Stage** **2nd, 3rd, ... Gain Stages**
Symbol	
Function	Amplify downconverted signal from the Mixer
Key Parameters **Typical Markets**	**NF** (dB) - lower is better **Gain** (dB) - higher is better **P_{1dB} power** (dBm) - higher is better
IF up to **500 MHz** • Cellular & cordless telephones • 900 MHz ISM band Wireless Data RF Tags & RF/ID Reader • Mobile Radio (SMR) • Pagers/messaging • Wireless modems • GPS (1.5 GHz) • 2.4 GHz ISM band Wireless Data RF Tags & RF/ID Reader • PCS (1.8 GHz) • MMDS (2 GHz)	HPMX-5002 includes this function **Silicon RFIC** INA series (low NF, high Gain), especially INA-30311 MSA series (moderate NF, higher P1dB, low $) IVA series (differential, variable gain) **Silicon Bipolar Transistor** AT-415xx (easy to use) AT-305xx, 310xx, 320xx (low bias) HBFP-04xx (high Gain, low bias) **NOTE**: Many wireless systems use low frequencies (45 MHz, 70 MHz, etc.) for the IF. HP amplifier products may not be the most cost effective solutions for these lower frequencies.
IF up to **2000 MHz** • 5.8 GHz ISM band Wireless Data RF Tags & RF/ID Reader • TVRO (4 GHz) • DBS/DSS (12 GHz) • VSAT (12 GHz)	**Silicon RFIC** INA series (high Gain) MSA series (higher P1dB, low $) **Silicon Bipolar Transistor** AT-415xx (easy to use) AT-305xx, 310xx, 320xx (low bias) HBFP-04xx (high Gain, low bias) **GaAs RFIC** MGA series (very low NF)

Transmitters



Modulator

Name	**QPSK (Vector) Modulator**
Symbol	**DATA & LO inputs**  **RF out**
Function	Digital phase modulation
Key Parameters / **Typical Markets**	**Modulation Type** (QPSK, QAM, MPSK...) **Modulation Error** (%) - lower is better **Amplitude Imbalance** (dB) - lower is better **Error** (Modulation error, amp imbalance, ...) **Phase Imbalance** (degrees) - lower is better **P_{1dB} Output Power** (dBm) - higher is better **LO Leakage** (dBc) - higher is better **Architecture** (direct, dual conversion, offset loop)
RF up to **900 MHz** • Cellular & cordless telephones • 900 MHz ISM band Wireless Data RF Tags & RF/ID Reader Wireless modems • Mobile Radio (SMR) • Ack back Pagers/messaging	**Silicon RFIC Vector Modulator** HPMX-2007 (5 - 4000 MHz) **BPSK Type Modulator** HPMX-2006 **FSK (LO):** see LO
RF up to **2.5 GHz** • 2.4 GHz ISM band Wireless Data RF Tags & RF/ID Reader Wireless modems • PCS (1.8 GHz) • MMDS (2 GHz) • PCN/DCS (1.8 GHz) • PCS (1.9 GHz)	**BPSK Type Modulator** HPMX-5001 HPMX-2006 **Silicon RFIC Vector Modulator** HPMX-2007 (general purpose) **FSK (LO):** see LO **NOTE**: HPMX-200X circuits are used to modulate a 25 to 1000 MHz carrier signal which is then upconverted (IAM series Mixer or incorporated mixer in case of HPMX-2007) to these higher frequency bands *see mixers*
RF up to **6 GHz** • 5.8 GHz ISM band Wireless Data RF Tags & RF/ID Reader	

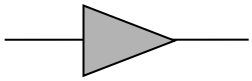
Transmitters

Gain Stages & Driver

Name	**Gain Stage**	**Driver Amplifier**
Symbol		
Function	Increase power level	Amplifies a signal for further processing
Key Parameters / **Typical Markets**	**Gain** (dB) - higher is better **P_{1dB} Output Power** (dBm) - higher is better	**P_{1dB} Output Power** (dBm) - higher is better **Gain** (dB) - higher is better **Efficiency** (%)
RF up to **900 MHz** • Cellular & cordless telephones • 900 MHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • Mobile Radio (SMR) • CATV • Pagers/messaging	**Silicon RFIC** INA series MSA series **Silicon Bipolar Transistor** AT-415xx, 420xx, 320xx, 310xx HBFP-04xx	**Silicon RFIC** HPMX-3002 Driver Amplifier (+23 dBm) HPMX-3003 Power Amp (+27.5 dBm) MSA-05xx (+23 dBm) MSA-1105 (+17 dBm) **Discrete Transistor** AT-415, 414, 420, 640 series AT-31625 (+28 dBm) AT-38086 (+23.5 dBm, CW) (+28.0 dBm, pulsed) ATF-4xxxx
RF up to **2.5 GHz** • 2.4 GHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • PCS (1.8 GHz) • MMDS (2 GHz)	**Silicon RFIC** INA series MSA series **GaAs RFIC** MGA-865xx (+6 dBm) MGA-81563 (+14 dBm) **Discrete Transistor** AT-415xx, 420xx, 320xx, 310xx HBFP-04xx ATF-10736, ATF-21186 (+19 dBm)	**GaAs RFIC** MGA-82563 (+17 dBm) MGA-83563 (+20 dBm) HPMX-3003 (+25 dBm) **Discrete Transistor** AT-380xx (+23 dBm) AT-414xx & 415xx (+19 dBm) AT-420xx (+21 dBm) AT-640xx (+25 dBm) ATF-10736, ATF-21186 (+19 dBm) ATF-4xxxx (+27 to +32 dBm)
RF up to **6 GHz** • 5.8 GHz ISM band Wireless Data RF Tag & RF/ID Reader	**GaAs RFIC** MGA-865xx (+6 dBm) MGA-81563 (+14 dBm) **GaAs FET** ATF-10xxx (+18 dBm) ATF-13xxx (+17 dBm)	**GaAs RFIC** MGA-82563 (+17 dBm) MGA-83563 (+20 dBm) **GaAs FET** ATF-10736 (+18 dBm) ATF-211xx (+19 dBm) ATF-4xxxx (+27 to +32 dBm)

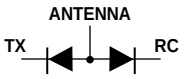
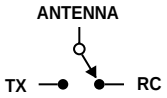
Transmitters

Power Amplifier

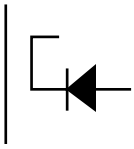
Name	**Power Amplifier**
Symbol	
Function	Boost carrier to final transmit power level
Key Parameters **Typical Markets**	**P_{1dB} Output Power** (dBm) - higher is better **Gain** (dB) - higher is better **Intercept Point, IP_3** (dBm) - higher is better
RF up to **900 MHz** • Cellular & cordless telephones • 900 MHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • Mobile Radio (SMR) • CATV • Pagers/messaging	**Silicon RFIC** HPMX-3002 (+23 dBm) MSA-05xx (+23 dBm) **Silicon Bipolar Transistor** AT-420xx (+20 dBm) AT-640xx (+27 dBm) AT-36408 (+35 dBm, pulsed) AT-33225 (+31 dBm) AT-31625 (+28 dBm) AT-38086, AT-38043 (+23.5 dBm, CW / +28.0 dBm, pulsed) **GaAs FET** ATF-421xx (+27 to +31 dBm)
RF up to **2.5 GHz** • 2.4 GHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • PCS (1.8 GHz) • MMDS (2 GHz)	**Silicon Bipolar Transistor** AT-420xx (+20 dBm) AT-640xx (+27 dBm) **GaAs FET** ATF-10736 (+20 dBm), ATF-21186 (+19 dBm) ATF-44101 (+32 dBm), ATF-451xx (+29 dBm) ATF-46101 (+27 dBm) **GaAs RFIC** HPMX-3003 (+27.5 dBm)
RF up to **6 GHz** • 5.8 GHz ISM band Wireless Data RF Tag & RF/ID Reader • Point-to-Point Microwave links • SATCOM	**GaAs FET** ATF-10736 (+18 dBm) ATF-21186 (+19 dBm) ATF-4xxxx (+27 to +31 dBm)

Transmitters

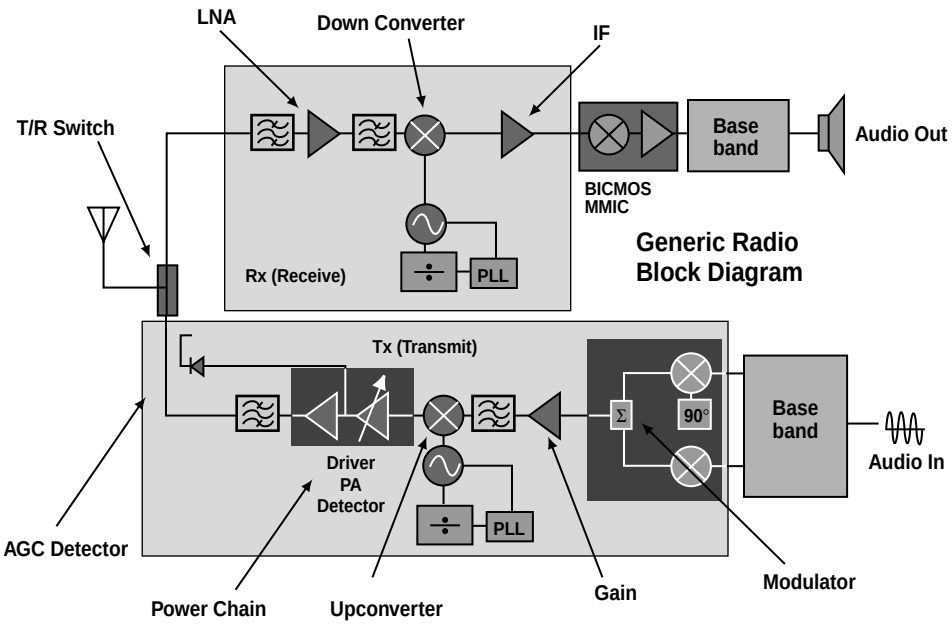
T/R Switch

Name	**Transmit/Receive (T/R) Switch**	
Symbol		
Function	Alternately switch antenna between transmitter and receiver	
Key Parameters / **Typical Markets**	Discrete PIN Diode **Series Resistance**, **Rs** (ohms) - lower is better **Capacitance, C_T** (pF) - lower is better	RFIC **Insertion Loss** (dB) - lower is better **Isolation** (dB) - higher is better **P_{1dB} Power** (dBm) - higher is better **Intercept Point, IP_3** (dBm) - higher is better
RF up to **900 MHz** • Cellular & cordless telephones • 900 MHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • Mobile Radio (SMR) • CATV • Pagers/messaging	**PIN Diode** HSMP-382x (low current) HSMP-386x (very low cost) HSMP-387x (low capacitance) HSMP-3880 (high power & ultra low distortion) HSMP-389x (high performance) HSMP-389U (series shunt PIN)	
RF up to **2.5 GHz** • 2.4 GHz ISM band Wireless Data RF Tag & RF/ID Reader Wireless modems • PCS (1.8 GHz) • MMDS (2 GHz)	**PIN Diode** HSMP-386x (very low cost) HSMP-387x (low capacitance) HSMP-389x (high performance) HSMP-489x (high performance)	**GaAs RFIC** HPMX-3003 (LNA, switch, PA)
RF up to **6 GHz** • 5.8 GHz ISM band Wireless Data RF Tag & RF/ID Reader • TVRO (4 GHz)	**PIN Diode** HSMP-489x (high performance; shunt applications) HSMP-387x (low capacitance; series applications)	**GaAs MMICs** HMMC-2006 SPDT reflective switch HMMC-2007 SPDT absorptive switch HMMC-2027 SPDT absorptive switch

AGC Detector

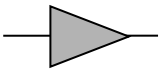
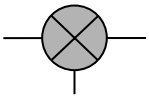
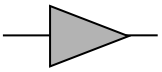
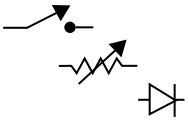
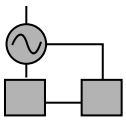
Name	**AGC Detector**
Symbol	
Key Parameters / **Typical Markets**	Discrete Schottky Diode **Temperature stability** **High output voltage**
RF up to **900 MHz** • Cellular & cordless telephones • Cellular base stations • Mobile Radio (SMR)	**Schottky Diode** HSMS-282x (very low cost)
RF up to **2.5 GHz** • PCS (1.8 GHz)	**Schottky Diode** HSMS-282x (very low cost)
RF up to **10 GHz** • other applications	**Schottky Diode** HSMS-286x (low capacitance)

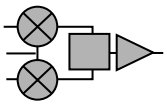
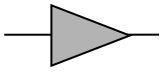
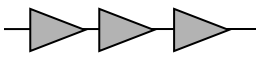
Wireless Markets



Cellular Handset

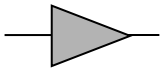
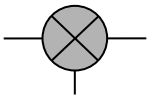
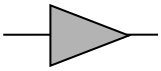
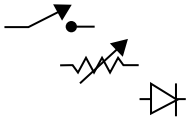
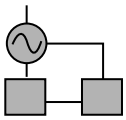
800–900 MHz
AMPS (North American Analog Cellular)

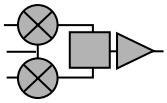
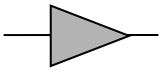
Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators Detectors**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/or modulator
Downlink (handset receive): 869-894 MHz	**3-VOLT:** **Discrete Devices** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Integrated Circuits** INA-30311 INA-12063 MGA-855xx	**3-VOLT:** **Discrete Devices** AT-305xx AT-310xx AT-320xx AT-415xx HSMS-2829	**3-VOLT:** **Integrated Circuits** INA-30311 INA-12063 INA-32063	**PIN Diode** (switch and attenuator) HSMP-386x HSMP-389x **Schottky Diodes** (detector) HSMS-282x	**VCO** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Buffers** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx or INA-31063 **CMOS Frequency Synthesizer:** HPLL-8001

Transmitter			
Name	**Modulator**	**Driver**	**Power Chain**
Symbol			
Function	FM modulated VCO	"Glue" part that amplifies modulator output sufficiently to drive power chain	Amplifies outgoing signal for broadcast, sets to correct power level
Uplink (handset transmit): 824-849 MHz	**Discrete Devices** AT-305xx AT-310xx AT-320xx AT-415xx	**3-VOLT:** **Discrete Devices** AT-310xx AT-320xx AT-415xx HBFP-04xx **Integrated Circuits** MGA-81563 INA-34063	**Discrete Devices** AT-38086 AT-33225 HSMS-282x detector diodes for power control

Cellular Handset

1.8 GHz
DCS-1800 (Pan-European digital standard for personal communications)

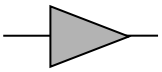
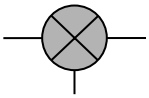
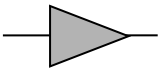
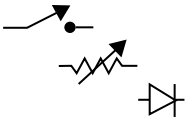
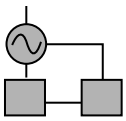
Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/or modulator
Downlink (handset receive): 1710-1785 MHz	**Discrete Devices** HBFP-04xx **Integrated Circuits** MGA-87563 MGA-85563	**Integrated Circuits** IAM-91563	**Integrated Circuits** INA-30311 INA-12063	**PIN Diode** (switch and attenuator) HSMP-386x HSMP-389x	**Oscillator** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Buffers** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx or INA-31063 **CMOS Frequency Synthesizer:** HPLL-8001

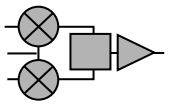
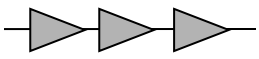
Transmitter			
Name	**Modulator**	**Driver**	**Power Chain**
Symbol			
Function	FM modulated VCO	"Glue" part that amplifies modulator output sufficiently to drive power chain	Amplifies outgoing signal for broadcast, sets to correct power level
Uplink (handset transmit): 1805-1880 MHz	**Integrated Circuit** HPMX-2007	**Discrete Devices** AT-32011 HBFP-0420 **Integrated Circuits** MGA-81563 MGA-82563 INA-34063	**Discrete Devices** AT-38043, ATF-21186 for power to 100 mW, HSMS-282x detector diodes for power control **Integrated Circuits** MGA-82563 MGA-81563 MGA-83563

Cellular Handset

800–900 MHz

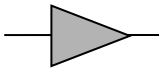
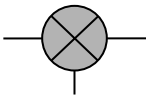
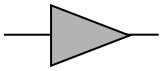
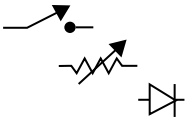
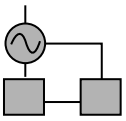
GSM 900 (Pan-European Digital Cellular for mobile communications)

Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators Detectors**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/or modulator
Downlink (handset receive): 935-960 MHz	**3-VOLT:** **Discrete Devices** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Integrated Circuits** INA-12063	**3-VOLT:** **Discrete Devices** AT-305xx AT-310xx AT-320xx **Integrated Circuits** IAM-91563 IC Mixer	**3-VOLT:** **Integrated Circuits** INA-30311 INA-32063	**PIN Diode** (switch and attenuator) HSMP-386x HSMP-389x **Schottky Diodes** (detector) HSMS-282x	**VCO** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Buffers** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx or INA-31063 **CMOS Frequency Synthesizer:** HPLL-8001

Transmitter		
Name	**Modulator**	**Power Chain**
Symbol		
Function	FM modulated VCO	Amplifies outgoing signal for broadcast, sets to correct power level
Uplink (handset transmit): 890-915 MHz	**3-VOLT:** HPMX-2007 (dual conversion architecture) HPMX-2006 (upconverter)	**Discrete Devices** HBFP-04xx AT-38086 HSMS-282x detector diodes for power control **Driver** **3V:** AT-320xx AT-415xx HBFP-0420 MGA-81563

Cellular Handset

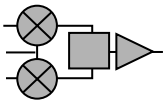
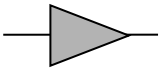
800–900 MHz
NADC (North American Digital Cellular)

Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/or modulator
Downlink (handset receive): 869-894 MHz	**IS-54 (TDMA):** **Discrete Devices** AT-310xx AT-320xx HBFP-04xx **Integrated Circuits** INA-12063 MGA-855xx **IS-95 (CDMA):** **Discrete Devices** AT-310xx AT-320xx ATF-21186 HBFP-04xx	**3-VOLT:** **Integrated Circuits** IAM-91563	**3-VOLT:** **Integrated Circuits** INA-30311 INA-12063 INA-32063	**PIN Diode** (switch) HSMP-386x HSMP-389x **PIN Diode** (attenuator) HSMP-381x HSMP-4810 HSMP-386x	**Oscillator** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Buffers** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx or INA-31063 **CMOS Frequency Synthesizer:** HPLL-8001
	IS-95: **Discrete Devices** HBFP-0420 AT-320/310xx **Integrated Circuits** INA-12063 MGA-87563	**Discrete Devices** HSMS-2829 **Integrated Circuits** HPMX-2006 IAM-91563	**Integrated Circuits** INA-30311 INA-12063 INA-32063	**PIN Diode** (switch) HSMP-386x HSMP-389x **PIN Diode** (attenuator) HSMP-381x HSMP-4810 HSMP-386x	**Oscillator** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Buffers** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx or INA-31063 **CMOS Frequency Synthesizer:** HPLL-8001

Cellular Handset

800–900 MHz

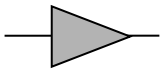
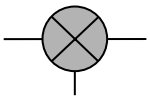
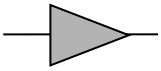
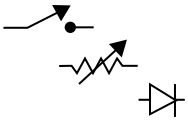
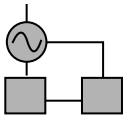
NADC (North American Digital Cellular)

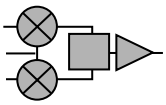
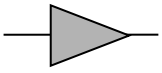
Transmitter			
Name	**Modulator**	**Driver**	**Power Chain**
Symbol			
Function	FM modulated VCO	"Glue" part that amplifies modulator output sufficiently to drive power chain	Amplifies outgoing signal for broadcast, sets to correct power level
IS-54, IS-95: Uplink (handset transmit): 824-849 MHz	**3-VOLT:** HPMX-2007 dual conversion architecture, HPMX-2006 as upconverter (dual conversion)	**3-VOLT:** **Integrated Circuits** MGA-81563 INA-34063 **Discrete Devices** HBFP-0420 AT-320xx AT-415xx	**Discrete Devices** HSMS-282x detector diodes for power control AT-38043 (to 100 mW) **Integrated Circuits** MGA-82563 as driver, MGA-83563

Cellular Handset

900/1500 MHz

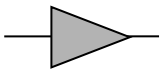
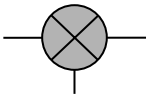
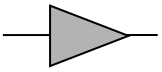
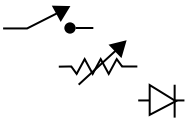
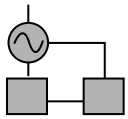
PDC (Japanese Digital Cellular standard for mobile communications)

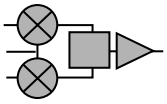
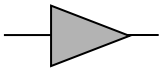
Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/or modulator
900 MHz and/or 1500 MHz	**Discrete Devices** AT-320xx HBFP-04xx **Integrated Circuits** MGA-87563	**Discrete Devices** HSMS-2829 HBFP-04xx AT-320xx **Integrated Circuits** IAM-91563	**3-VOLT:** INA-30311 INA-32063	**PIN Diode** (switch and attenuator) HSMP-386x series HSMP-389x series	**Oscillator** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Buffers** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx or INA-31063 **CMOS Frequency Synthesizer:** HPLL-8001

Transmitter			
Name	**Modulator**	**Driver**	**Power Chain**
Symbol			
Function	FM modulated VCO	"Glue" part that amplifies modulator output sufficiently to drive power chain	Amplifies outgoing signal for broadcast, sets to correct power level
	3-VOLT: HPMX-2007 dual conversion HPMX-2006 (for use as an upconverter with dual conversion architecture)	**Discrete Devices** HBFP-0420 AT-320xx **Integrated Circuits** MGA-81563	**3-VOLT:** **Discrete Devices** AT-38043 HSMS-282x detector diodes for power control **Integrated Circuits** MGA-82563 MGA-83563

Cellular Handset

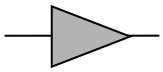
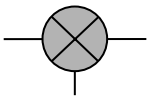
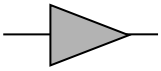
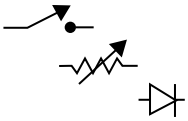
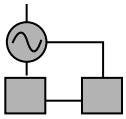
1.9 GHz
PHS (Japanese digital standard for personal communications)

Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/or modulator
Downlink (handset receive): 1895-1907 MHz	**Discrete Devices** AT-320xx HBFP-0405, -0420 **Integrated Circuits** MGA-87563 MGA-85563	**Discrete Devices** HSMS-2829 AT-320xx **Integrated Circuits** IAM-91563	**Integrated Circuits** INA-30311 INA-32063	**PIN Diode** (switch and attenuator) HSMP-386x series HSMP-389x series	**Oscillator** AT-305xx AT-310xx AT-320xx HBFP-04xx **Buffers** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx or INA-31063 **CMOS Frequency Synthesizer:** HPLL-8001

Transmitter			
Name	**Modulator**	**Driver**	**Power Chain**
Symbol			
Function	FM modulated VCO	"Glue" part that amplifies modulator output sufficiently to drive power chain	Amplifies outgoing signal for broadcast, sets to correct power level
Uplink (handset transmit): 1895-1907 MHz	HPMX-2007 HPMX-2006 as an upconverter	**Discrete Devices** AT-32011 HBFP-0420 **Integrated Circuits** MGA-81563 INA-34063	**Discrete Devices** AT-38043 for power to 100 mW HSMS-282x detector diodes for power control **Integrated Circuits** MGA-82563 MGA-83563

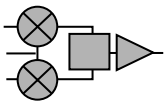
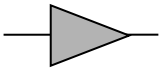
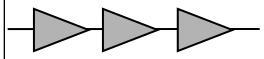
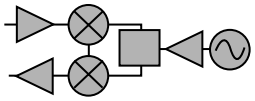
1900 MHz

USPCS (U.S. Personal Communications Service)

Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/or modulator
	3-VOLT: **Discrete Devices** AT-305xx AT-310xx AT-320xx HBFP-04xx **Integrated Circuits** MGA-87563 MGA-85563 HPMX-3003 includes the LNA function	**3-VOLT:** **Discrete Devices** HSMS-2829 **Integrated Circuits** IAM-91563 HPMX-2006 HPMX-5001 includes this function (TAG-6*)	**3-VOLT:** **Integrated Circuits** INA-30311 INA-32063 HPMX-5002 includes this function (TAG-6*)	**PIN Diode** (switch) HSMP-386x HSMP-389x HSMP-4890 HPMX-3003 includes the switch function	**VCO** AT-305xx AT-310xx AT-320xx **Buffers** HBFP-04xx AT-305xx AT-310xx AT-320xx ATF-21186 or INA-31063 **CMOS Frequency Synthesizer:** HPLL-8001 **System Solution:** HPMX-5001/HPMX-5002 (TAG-6*)

*TAG-6 = DECT-like version of US PCS

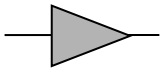
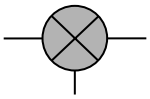
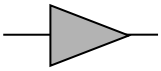
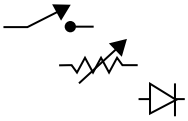
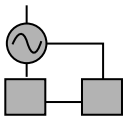
1900 MHz
USPCS (U.S. Personal Communications Service)

Transmitter					
Name	**Baseband**	**Modulator**	**Driver**	**Power Chain**	**Multi-Function**
Symbol					
Function	Provides data inputs to modulator, converts output of IF into information	FM modulated VCO	"Glue" part that amplifies modulator output sufficiently to drive power chain	Amplifies outgoing signal for broadcast, sets to correct power level	
	HPMX-5002 includes part of this function (TAG-6 *)	**3-VOLT:** HPMX-2007, HPMX-2006 as an upconverter HPMX-5002 includes this function (TAG-6*)	**3-VOLT:** **Discrete Devices** AT-32011 HBFP-0420 **Integrated Circuits** MGA-81563	**Discrete Devices** AT-38043 ATF-21186 for power to 100 mW, HSMS-282X detector diodes for power control **Integrated Circuits** MGA-82563 MGA-81563 MGA-83563 HPMX-3003 includes the PA function	**Up/Down converter IC** HPMX-5001 (TAG-6*) **IF Amplifier/ demodulator IC** HPMX-5002 (TAG-6*) **LNA switch PA** HPMX-3003

*TAG-6 = DECT-like version of US PCS

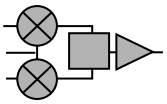
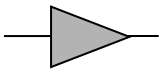
Cordless Handset

1.8–2 GHz
DECT (Digital European Cordless Telecommunications)

Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/or modulator
	Discrete Devices AT-320xx AT-310xx HBFP-04xx **Integrated Circuits** MGA-87563 MGA-85563 HPMX-3003 includes the LNA function	**Integrated Circuits** IAM-91563 HPMX-5001 includes this function	HPMX-5002 performs IF amplification plus demodulation and data slicing INA-30311 & INA-32063 can be used as IF amplifier	**PIN Diode** (switch) HSMP-386x HSMP-389x HSMP-4890 HPMX-3003 includes the switch function **PIN Diode** (attenuator) HSMP-381x HSMP-4810 HSMP-386x	**Oscillator** AT-305xx AT-310xx AT-320xx HBFP-04xx **Buffers** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx or INA-31063 **CMOS Frequency Synthesizer:** HPLL-8001 HPMX-3003, HPMX-5001/HPMX-5002 combined with the HPLL-8001 provide a complete solution

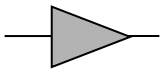
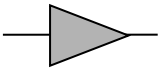
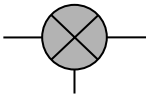
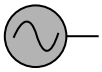
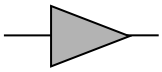
Cordless Handset

1.8–2 GHz
DECT (Digital European Cordless Telecommunications)

Transmitter			
Name	**Modulator**	**Driver**	**Power Chain**
Symbol			
Function	FM modulated VCO	"Glue" part that amplifies modulator output sufficiently to drive power chain	Amplifies outgoing signal for broadcast, sets to correct power level
	HPMX-5001/HPMX-5002 chipset include this function For systems using modulated VCO, HBFP-04xx, AT-415xx, AT-320xx, AT-310xx, AT-305xx as oscillator For systems using IQ modulation, HPMX-2007	**Discrete Devices** AT-320xx HBFP-04xx **Integrated Circuits** MGA-81563 MGA-85563 INA-34063	**Discrete Devices** AT-38043 ATF-21186 for power to 100 mW HSMS-282x detector diodes for power control **Integrated Circuits** MGA-82563 MGA-83563 HPMX-3003 includes the PA function

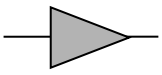
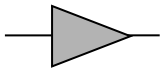
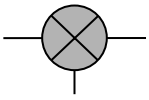
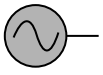
Low Noise Block Downconverter

TV Delivery (4 GHz, 12 GHz)

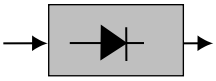
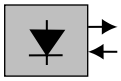
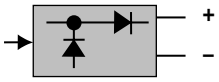
Name	LNA	RF Gain	Mixer	Oscillator	IF Amplifier
Symbol					
Function	Amplifies incoming signal	Amplifies incoming signal	Converts signal	Provides signal for downconversion	Low frequency amplification
4 GHz	**Discrete Devices** ATF-36077 ATF-36163	**Discrete Devices** ATF-36163 as Q2, AT-41511 as Q3 HBFP-04xx	**Schottky Diode Mixers** HSMS-820x HSMS-282x MSA-0885 as self oscillating mixer	**Discrete Devices** AT-41511	**Discrete Devices** AT-415xx HBFP-04xx **Integrated Circuits** *INA-51063 + INA-54063,* INA-03184 INA-34063 INA-10386 INA-52063 MSA-0886
12 GHz	**Discrete Devices** ATF-36077	**Discrete Devices** ATF-36163	**Discrete Devices** ATF-36163 as PHEMT active mixer HSMS-8202 as passive diode mixer	**Discrete Devices** AT-3310xx AT-320xx ATF-13786 ATF-26886 HBFP-04xx	**Integrated Circuits** INA-51063 INA-54063 INA-03184 INA-10386 MSA-0886 **Discrete Devices** AT-415xx

Receive Only Pager

930 MHz

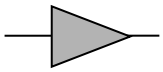
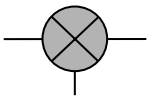
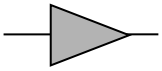
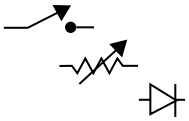
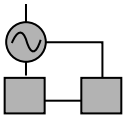
Name	LNA	Attenuator	IF Amplifier	Downconverter	Oscillator
Symbol					
Function	Amplifies incoming signal	Amplifies incoming signal	Low frequency amplification	Converts signal	Provides signal for downconversion
	Discrete Devices AT-305xx AT-310xx AT-320xx AT-32063 dual transistor as cascode LNA HBFP-04xx	**Discrete Devices** HSMP-3862 as low current attenuator	**Discrete Devices** AT-305xx AT-310xx AT-320xx HBFP-04xx	**Discrete Devices** AT-305xx AT-310xx AT-320xx HBFP-04xx	**Discrete Devices** AT-305xx AT-310xx AT-320xx HBFP-04xx

900 MHz, 2.4 GHz, 5.8 GHz Bands

Name	Limiter	Detector	Modulator	Virtual Battery
Symbol				
Function	Protects the detector diode from damage by high power input signals	Detects & demodulates interrogating signal received from the Tag Reader	"Backscatter" Tags: Amplitude modulates data onto the RF reflected by Tag	Rectifies RF to provide DC for active tag power supply. Usually a voltage doubler circuit.
Key Parameters / **Typical Markets**	PIN Diode: **Series Resistance, Rs** (Ω)	Schottky Diode: **Voltage Sensitivity,** γ (mV/μW) **TSS** (dBm) **Flicker Noise** (dBV/Hz)	PIN Diode: **Series Resistance, Rs** (Ω)	Schottky Diode: **Voltage Sensitivity,** γ (mV/μW) **Capacitance, C_T** (pF)
• Automotive Toll Tags • RF Datacom (RF/DC) • Automatic Identification • Security • Retail Shelf Price Tags • Animal Tracking • Smart Cards	**900 MHz**	**PIN Diode** HSMP-382x	**Schottky Diode** **0 Bias**: HSMS-285x **DC Bias**: HSMS-282x	**PIN Diode** HSMP-389x	**Schottky Diode** HSMS-2822 (diode pair for doubler)
	2.4 GHz	**PIN Diode** HSMP-482x	**Schottky Diode** **0 Bias**: HSMS-285x **DC Bias**: HSMS-282x	**PIN Diode** HSMP-489x	**Schottky Diode** HSMS-286x (low C_T diode pair for doubler)
	5.8 GHz	**PIN Diode** HSMP-482x	**Schottky Diode** **0 Bias**: HSMS-285x, HSCH-9161 (mmWave) **DC Bias**: HSMS-286x		**Schottky Diode** HSMS-286x (low C_T diode pair for doubler)

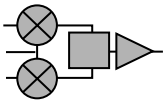
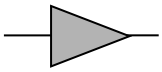
Unlicensed Applications

0.9/2.4/5.7 GHz
Spread Spectrum & Unlicensed Bands (ISM)

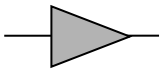
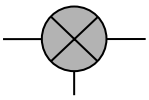
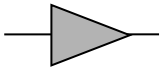
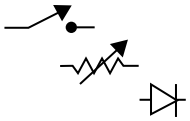
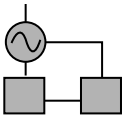
Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/or modulator
	Discrete Devices **0.9 and 2.4 GHz:** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx ATF-21186 ATF-10xxx **2.4 and 5.7 GHz:** HBFP-04xx ATF-10xxx ATF-13xxx ATF-36xxx ATF-21186 **Integrated Circuits** **0.9 GHz only:** INA-30311 INA-51063 **0.9 and 2.4 GHz:** INA-12063 HPMX-3003 **0.9, 2.4 and 5.7 GHz:** MGA-865xx MGA-875xx MGA-85563	**Discrete Devices** **0.9 and 2.4 GHz:** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx ATF-21186 ATF-10xxx HSMS-282x **5.7 GHz only:** HBFP-04xx ATF-36xxx ATF-10xxx ATF-13xxx HSMS-2829 **Integrated Circuits** **0.9 and 2.4 GHz:** IAM-81xxx IAM-82xxx HPMX-2006 **2.4 GHz only:** HPMX-5001	**Discrete Devices** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Integrated Circuits** INA-30311 INA-32063 INA-34063 INA-51063 MSA-0611 HPMX-5002	**T/R Switch** **0.9 and 2.4 GHz:** HSMP-386x **0.9, 2.4, 5.7 GHz:** HSMP-382x HSMP-389x **PIN Diode Attenuator** **0.9 and 2.4 GHz:** HSMP-386x **0.9, 2.4, 5.7 GHz:** HSMP-381x	**Oscillator** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Buffers** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx or INA, MSA or MGA gain blocks (INA-31063) **CMOS Frequency Synthesizer:** HPLL-8001

Unlicensed Applications

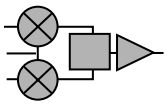
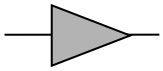
0.9/2.4/5.7 GHz
Spread Spectrum & Unlicensed Bands (ISM)

Transmitter			
Name	**Modulator**	**Driver**	**Power Chain**
Symbol			
Function	FM modulated VCO	"Glue" part that amplifies modulator output sufficiently to drive power chain	Amplifies outgoing signal for broadcast, sets to correct power level
	Modulated VCO: AT-320xx AT-320xx AT-415xx HBFP-04xx ATF-10xxx ATF-13xxx **BPSK:** HPMX-2006 **Vector Modulator:** **0.9 and 2.4 GHz:** HPMX-2007 (QPSK dual conv) **2.4 GHz only:** HPMX-5001/5002 (FSK) **5.7 GHz only:** Any of the above + HSMS-8xxx Schottky diode as upconverter	**Discrete Devices** **0.9 and 2.4 GHz:** AT-320xx AT-415xx AT-420xx HBFP-04xx ATF-10xxx ATF-211xx **2.4 and 5.7 GHz:** ATF-10xxx ATF-13xxx ATF-211xx **Integrated Circuits** **0.9 GHz only:** MSA-0611 MSA-2111 and other MSA and INA gain blocks **0.9, 2.4 and 5.7 GHz:** MGA-81563 MGA-85563 MGA-865xx and other MGA and INA gain blocks	**Discrete Devices** **0.9 GHz only:** AT-38043 AT-31625 AT-33225 **0.9 and 2.4 GHz:** AT-420xx AT-640xx **0.9, 2.4 and 5.7 GHz:** ATF-44xxx ATF-45xxx ATF-46xxx **Integrated Circuits** **0.9 GHz only:** HPMX-3002 MSA-05xx and other MSA and INA gain blocks **2.4 GHz only:** HPMX-3003 **0.9, 2.4 and 5.7 GHz:** MGA-82563 MGA-83563

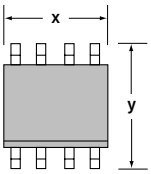
0.9 – 5.8 GHz
WLAN, 802.11, other

Receiver					
Name	**LNA**	**Down Converter**	**IF Amplifier**	**T/R Switches Attenuators**	**PLL/Frequency Synthesizer**
Symbol					
Function	Amplifies incoming signal	Converts output of LNA to IF frequency	Low frequency amplification	Multiple functions	Provides stable carrier for frequency conversion and/ or modulator
	Discrete Devices **0.9 and 2.4 GHz:** HBFP-04xx AT-305xx AT-310xx AT-320xx AT-415xx ATF-21186 ATF-10xxx **2.4 and 5.7 GHz:** HBFP-04xx ATF-10xxx ATF-13xxx ATF-36xxx ATF-21186 **Integrated Circuits** **0.9 GHz only:** INA-30311 INA-51063 **0.9 and 2.4 GHz:** INA-12063 HPMX-3003 **0.9, 2.4 and 5.7 GHz:** MGA-865xx MGA-875xx MGA-85563	**Discrete Devices** **0.9 and 2.4 GHz:** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx ATF-21186 ATF-10xxx HSMS-282x **5.7 GHz only:** ATF-36xxx ATF-10xxx ATF-13xxx HSMS-8202 **Integrated Circuits** **0.9 and 2.4 GHz:** IAM-81xxx IAM-82xxx **2.4 GHz only:** HPMX-5001 **0.9 to 5.7 GHz only:** IAM-91463	**Discrete Devices** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Integrated Circuits** INA-30311 INA-32063 INA-34063 INA-51063 MSA-0611 HPMX-5002	**T/R Switch** **0.9 and 2.4 GHz:** HSMP-386x MGS-70xxx **0.9, 2.4, 5.7 GHz:** HSMP-382x, HSMP-389x HPMX-3003 (includes switch) **PIN Diode Attenuator** **0.9 and 2.4 GHz:** HSMP-386x **0.9, 2.4, 5.7 GHz:** HSMP-381x	**Oscillator** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx **Buffers** AT-305xx AT-310xx AT-320xx AT-415xx HBFP-04xx or INA, MSA or MGA gain blocks (INA-31063, MGA-85563) **CMOS Frequency Synthesizer:** HPLL-8001
Together, HPMX-3003, HPMX-5001, HPMX-5002, and HPLL-8001 form a complete solution at **2.4 GHz**.					

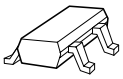
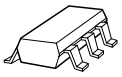
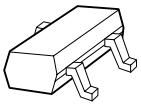
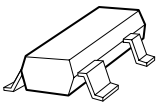
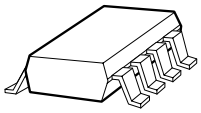
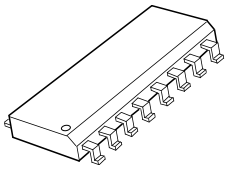
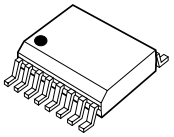
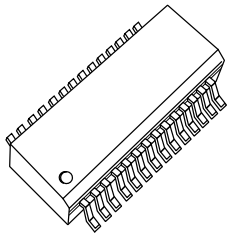
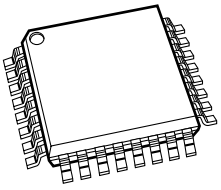
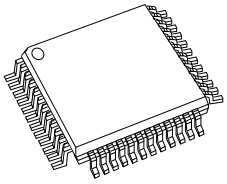
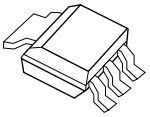
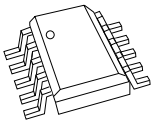
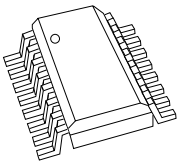
0.9 – 5.8 GHz
WLAN, 802.11, other

Transmitter			
Name	**Modulator**	**Driver**	**Power Chain**
Symbol			
Function	FM modulated VCO	"Glue" part that amplifies modulator output sufficiently to drive power chain	Amplifies outgoing signal for broadcast, sets to correct power level
	Modulated VCO: AT-320xx AT-320xx AT-415xx HBFP-04xx ATF-10xxx ATF-13xxx **FSK:** **2.4 GHz only:** HPMX-5001/5002 **BPSK:** HPMX-2006 **Vector Modulator:** **0.9 and 2.4 GHz:** HPMX-2007 (QPSK dual conv) **5.7 GHz only:** HPMX-2007 + HSMS-8xxx Schottky diode as upconverter	**Discrete Devices** **0.9 and 2.4 GHz:** AT-320xx AT-415xx AT-420xx ATF-10xxx ATF-211xx HBFP-04xx **2.4 and 5.7 GHz:** ATF-10xxx ATF-13xxx ATF-211xx HBFP-04xx **Integrated Circuits** **0.9 GHz only:** MSA-0611 MSA-2111 and other MSA and INA gain blocks **0.9, 2.4 and 5.7 GHz:** MGA-81563 MGA-85563 MGA-865xx and other MGA and INA gain blocks	**Discrete Devices** **0.9 GHz only:** AT-380xx AT-31625 AT-33225 **0.9 and 2.4 GHz:** AT-420xx AT-640xx **0.9, 2.4 and 5.7 GHz:** ATF-44xxx ATF-45xxx ATF-46xxx **Integrated Circuits** **0.9 GHz only:** HPMX-3002 MSA-05xx and other MSA and INA gain blocks **2.4 GHz only:** HPMX-3003 **0.9, 2.4 and 5.7 GHz:** MGA-82563 MGA-83563
Together, HPMX-3003, HPMX-5001, HPMX-5002, and HPLL-8001 form a complete FHSS solution at 2.4 GHz for 802.11.			

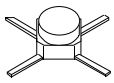
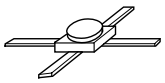
RF/mW Packaging *Quick* Reference



Plastic Surface Mount Packages

SOT323 (SC70)	SOT343 (SC70)	SOT363 (SC70)	SOT23	SOT143
				
3 lead 2.0 x 2.1 x 0.9 mm	4 lead 2.0 x 2.1 x 0.9 mm	6 lead 2.0 x 2.1 x 0.9 mm	3 lead 2.9 x 2.4 x 0.9 mm	4 lead 2.9 x 2.4 x 0.9 mm
SO8	**SO16**	**SSOP 16**	**SSOP28**	**TQFP 32**
				
8 lead 1.27 mm pitch 4.9 x 6.0 x 1.6 mm	16 lead 1.27 mm pitch 9.9 x 6.0 x 1.5 mm	16 lead 0.635 mm pitch 4.9 x 6.0 x 1.5 mm	28 lead 0.635 mm pitch 9.9 x 6.0 x 1.5 mm	32 lead 0.8 mm pitch 9.0 x 9.0 x 1.4 mm
TQFP 48	**MSOP 3**	**MSOP 10**	**MSOP 16**	**SMT 85 mil**
				
48 lead 0.5 mm pitch 9.0 x 9.0 x 1.4 mm	4 lead 4.8 x 4.8 x 1.3 mm	10 lead 0.635 mm pitch 3.0 x 4.8 x 1.3 mm	16 lead 0.635 mm pitch 4.9 x 4.8 x 1.3 mm	5.0 mm x 1.45 mm

Ceramic Packages

Micro-x	70 mil
	
4.57 x 1.45 mm	5.28 x 1.22 mm

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Data subject to change.

Obsoletes 5965-7732E
5968-2348E (10/98)