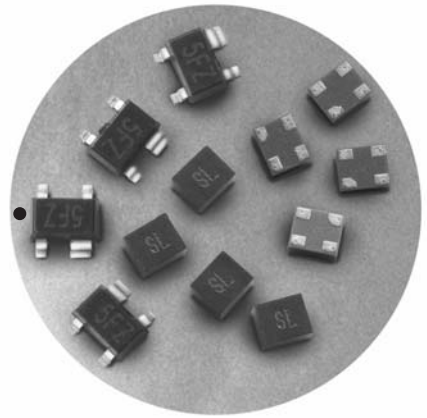


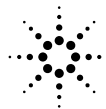
Agilent Part to Market Quick Guide for Wireless Communications

Version 6.0 Selection Guide



Semiconductor Solutions for the Connected World

www.agilent.com/semiconductors



Agilent Technologies

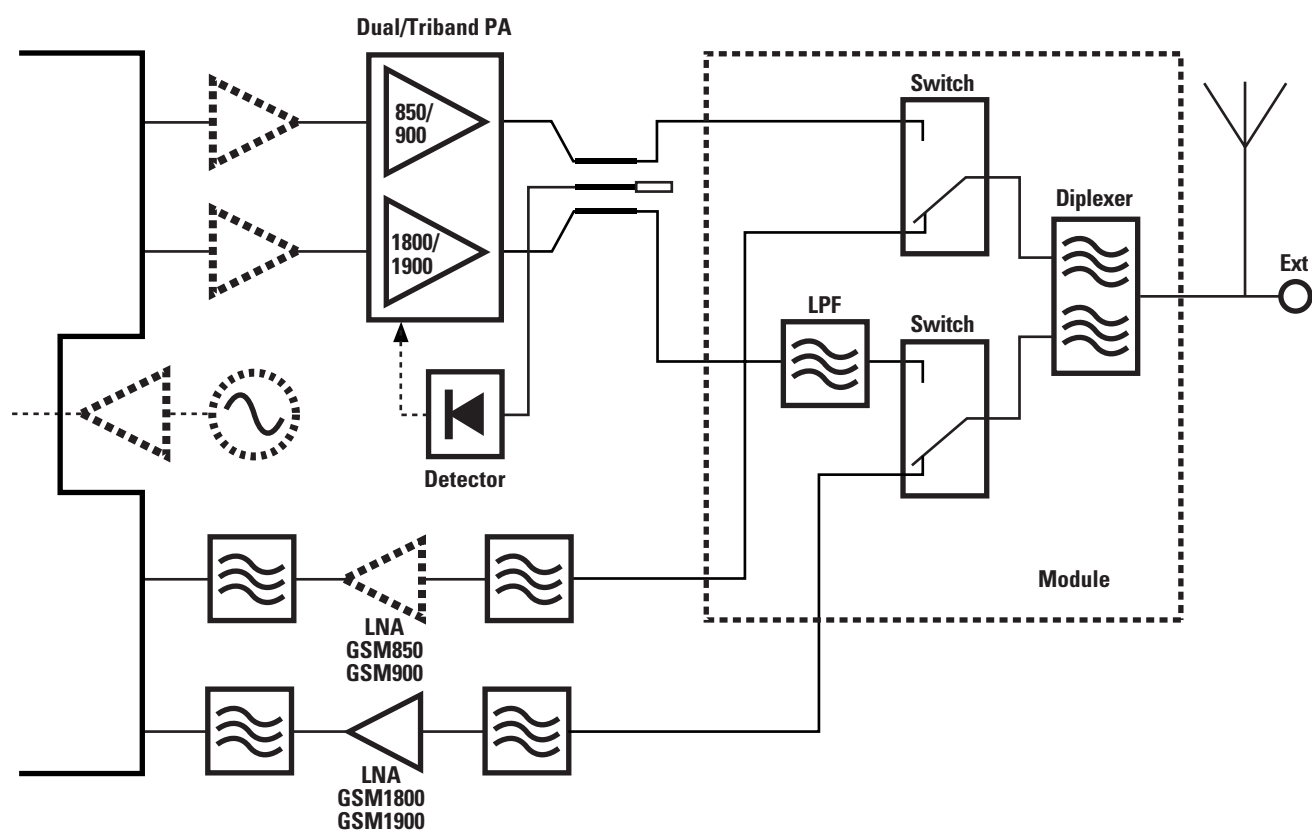
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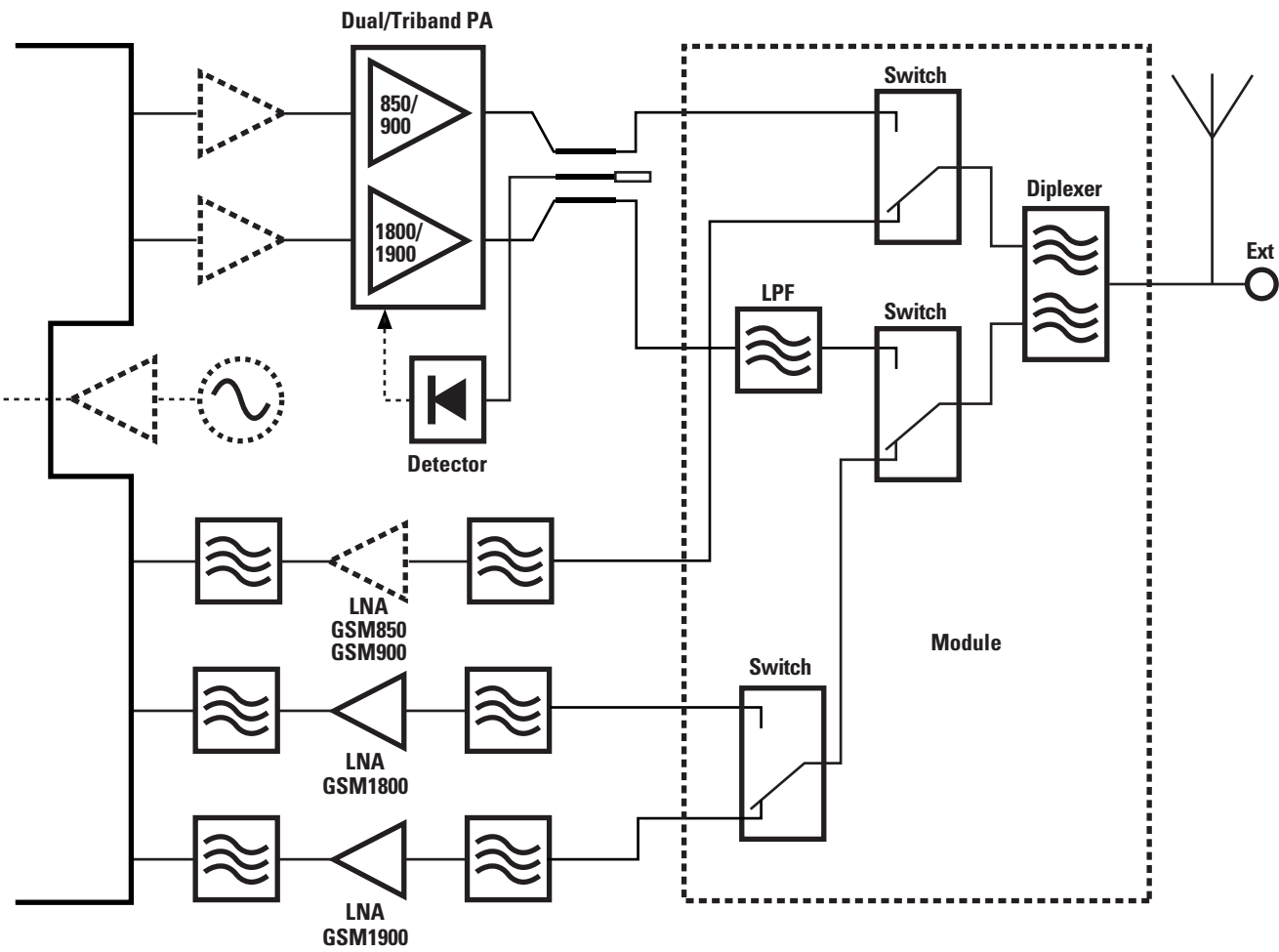
Abbreviations of Wireless Terms

CATV	Cable Television (50 to 300 MHz)	NF	Noise Figure
CDMA	Code Division Multiple Access	P1dB	Power level at 1.0 dB of gain compression
CDPD	Cellular Digital Packet Data	PCS	Personal Communications Services (1.9 GHz)
DBS	Direct Broadcast Satellite (12 GHz)	PCN	Personal Communications Network (DCS-1800 MHz)
DSP	Digital Signal Processor (baseband)	PDC	Personal Digital Cellular
DSS	Digital Satellite Service (12 GHz)	PMR	Private Mobile Radio
E-pHEMT	Enhancement mode pseudomorphic High Electron Mobility Transistor	PLL	Phase-Locked Loop
FWA	Fixed Wireless Access	RF	Radio Frequency
GaAs FET	Gallium Arsenide Field Effect Transistor	RF/DC	RF Data Communication
GPS	Global Positioning System (1.5 GHz)	RF/ID	RF Identification
GSM	Global System for Mobile Phones	RFIC	Radio Frequency Integrated Circuit
IF	Intermediate Frequency	RLL/WLL	Radio in the Local Loop/Wireless in the Local Loop
IP3	Third Order Intercept Point	Si BJT	Silicon Bipolar Transistor
ISM	Industrial-Scientific-Medical bands (e.g., 900 MHz; 2.4, 5.8 GHz)	SiGe	Silicon Germanium
LMDS	Local Microwave Distribution System	SMR	Specialized Mobile Radio (150, 450, 900 MHz)
MCPA	Multi-Carrier Power Amplifier	TDMA	Time Division Multiple Access
MMDS	Multipoint Microwave Distribution System - "Wireless Cable" (2.5 - 2.7 GHz)	T/R	Transmit/Receive
MMIC	Monolithic Microwave Integrated Circuit	TSS	Tangential Signal Sensitivity
		TVRO	Television Receive Only (3.7 - 4.2 GHz)

GSM Dualband Handset



GSM Triband Handset



GSM Dualband/Triband Handset

Suggested Components 1



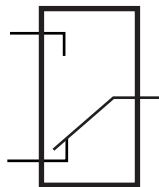
Dual/Triband PA Modules

- ACPM-7891 E-pHEMT



Detector

- HMPS-282x
Schottky MiniPak
- HSMS-282K/282L
Schottky SOT 363
- HSMS-286K/286L
Schottky SOT 363 low Cj
- HSMS-2825
Schottky SOT 143
- HSMS-2865
Schottky SOT 143 low Cj



Switch: PIN

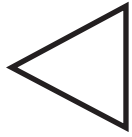
- HMPP-389x PIN MiniPak
- HSMP-389x/PIN SOT 323/363
- HSMP-389V Series/Shunt
SOT 363

Switch: PIN (lower harmonic)

- HMPP-386x PIN MiniPak
- HSMP-386x PIN SOT 323/363

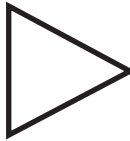
GSM Dualband/Triband Handset

Suggested Components 2



LNA GSM9000

- AT-32032 BJT Si



PA Driver: for high P_{in} PAs

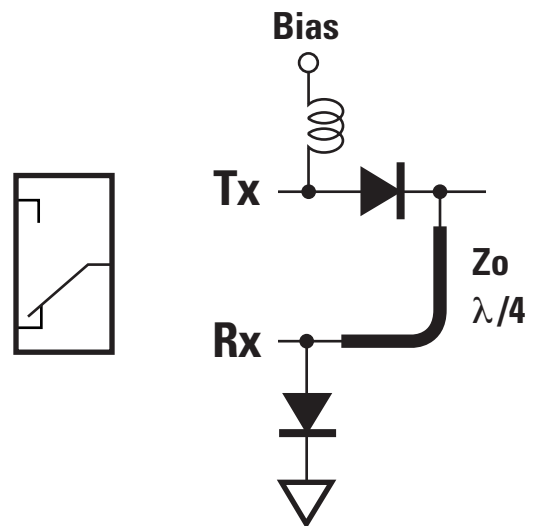
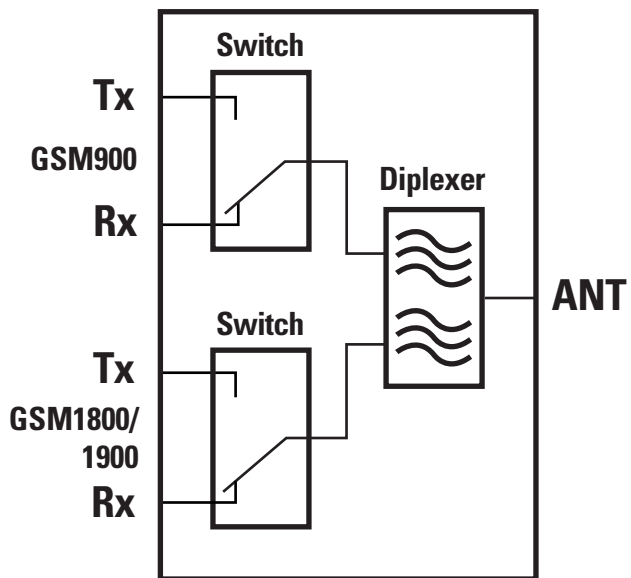
- MGA-81563 MMIC GaAs
- ATF-55143/551M4 FET E-pHEMT



LNA GSM1800/1900

- ATF-55143/551M4 FET E-pHEMT
- MGA-71543/72543/725M4

Front End Module



Switch: PIN

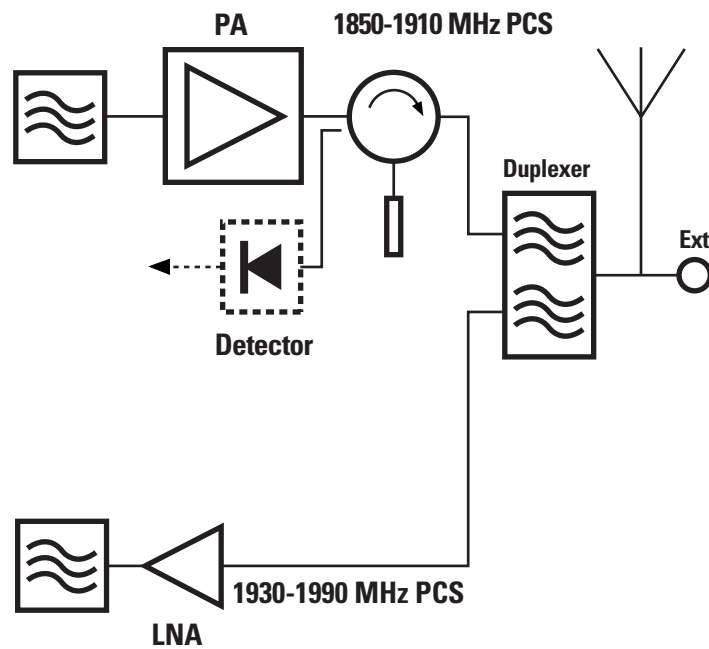
- HMPP-389x PIN MiniPak
- HSMP-389x PIN SOT 323/363
 - HSMP-389V Series/ Shunt SOT363

Switch: PIN (lower harmonic)

- HMPP-386x PIN MiniPak
- HSMP-386x PIN SOT 323/363

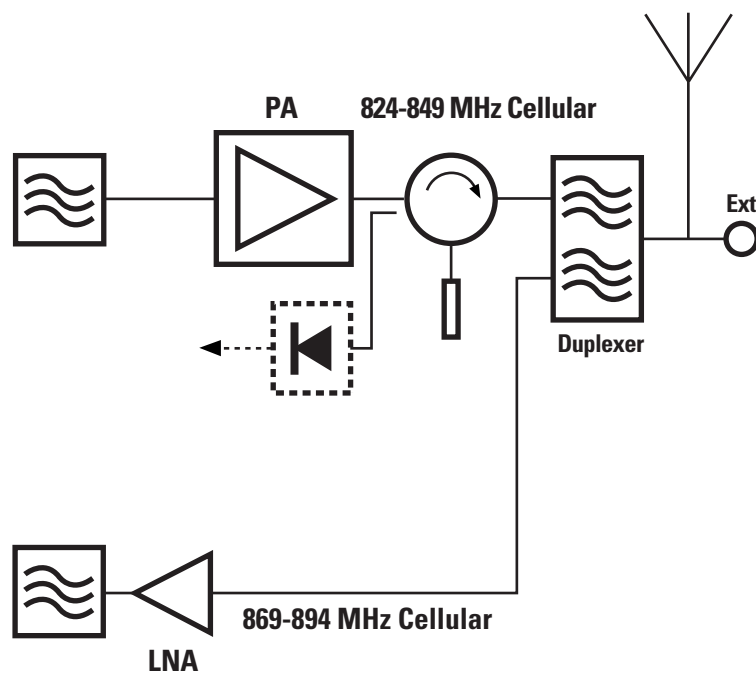
CDMA Handset SBSM PCS

(Single Band - Single Mode)



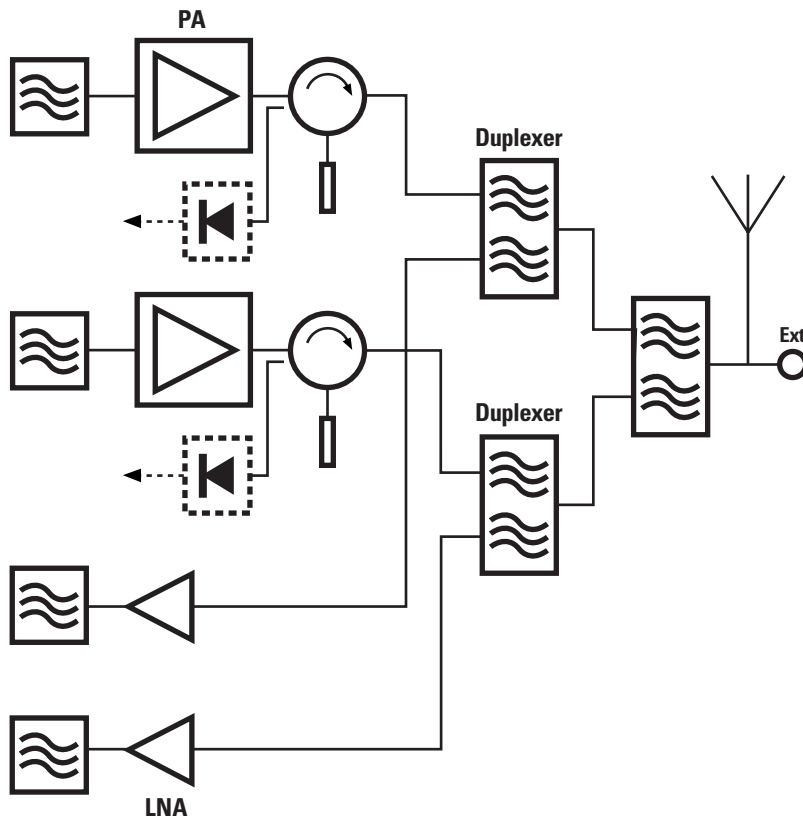
CDMA Handset SBSM, SBDM Cellular

(Single Band-Single Mode, Single Band-Dual Mode)

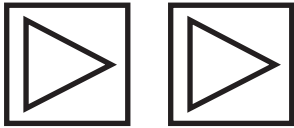


CDMA Handset DBDM, DBTM

(Dual Band-Dual Mode, Dual Band-Tri Mode)



CDMA Handset Suggested Components 1



PA Modules

- ACPM-7812 800 MHz E-pHEMT
- ACPM-7831 1900 MHz E-pHEMT



Duplexer

- HPMD-7904 PCS FBAR Duplexer
- HDMP-7905 PCS FBAR Duplexer



Detector

- HPMS-282x Schottky MiniPak
- HSMS-282K/282L Schottky SOT 363
- HSMS-286K/286L Schottky SOT 363
low Cj

CDMA Handset Suggested Components 2



LNA PCS

- MGA-71543 MMIC GaAs
- ATF-55143/551M4 FET E-pHEMT

LNA Cellular

- MGA-72543/725M4 MMIC GaAs



Tx Fullband Filter

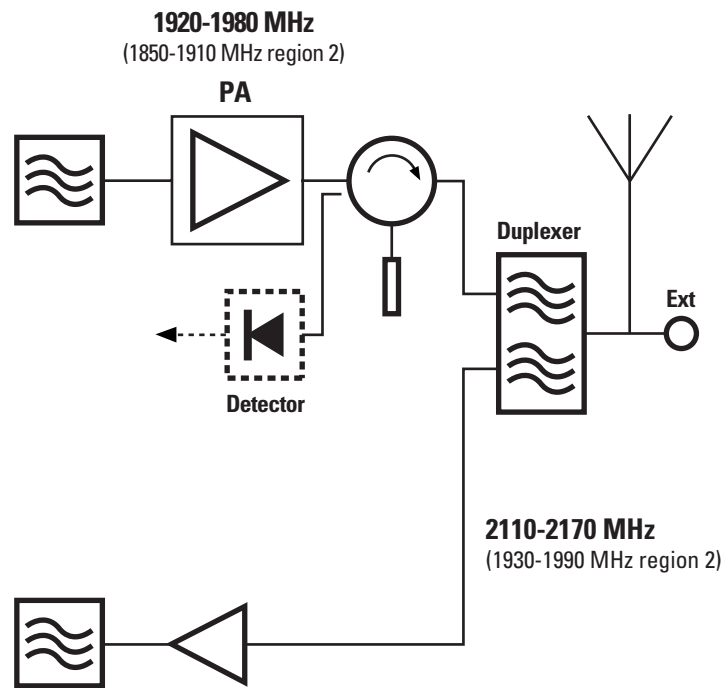
- ACPF-7001 PCS Band FBAR



LO Buffer

- AT-310xx/320xx BJT Si

W-CDMA Handset

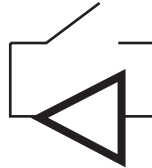


W-CDMA Handset Suggested Components 1



W-CDMA PA

- ACPM-7881 PA module E-pHEMT*



LNA with bypass

- MGA-71543 GaAs MMIC



Detector

- HMPS-282x Schottky MiniPak
- HSMS-282K Schottky SOT 363
- HSMS-286K Schottky SOT 363 low Cj



LNA without bypass

- ATF-55143/551M4 FET E-pHEMT



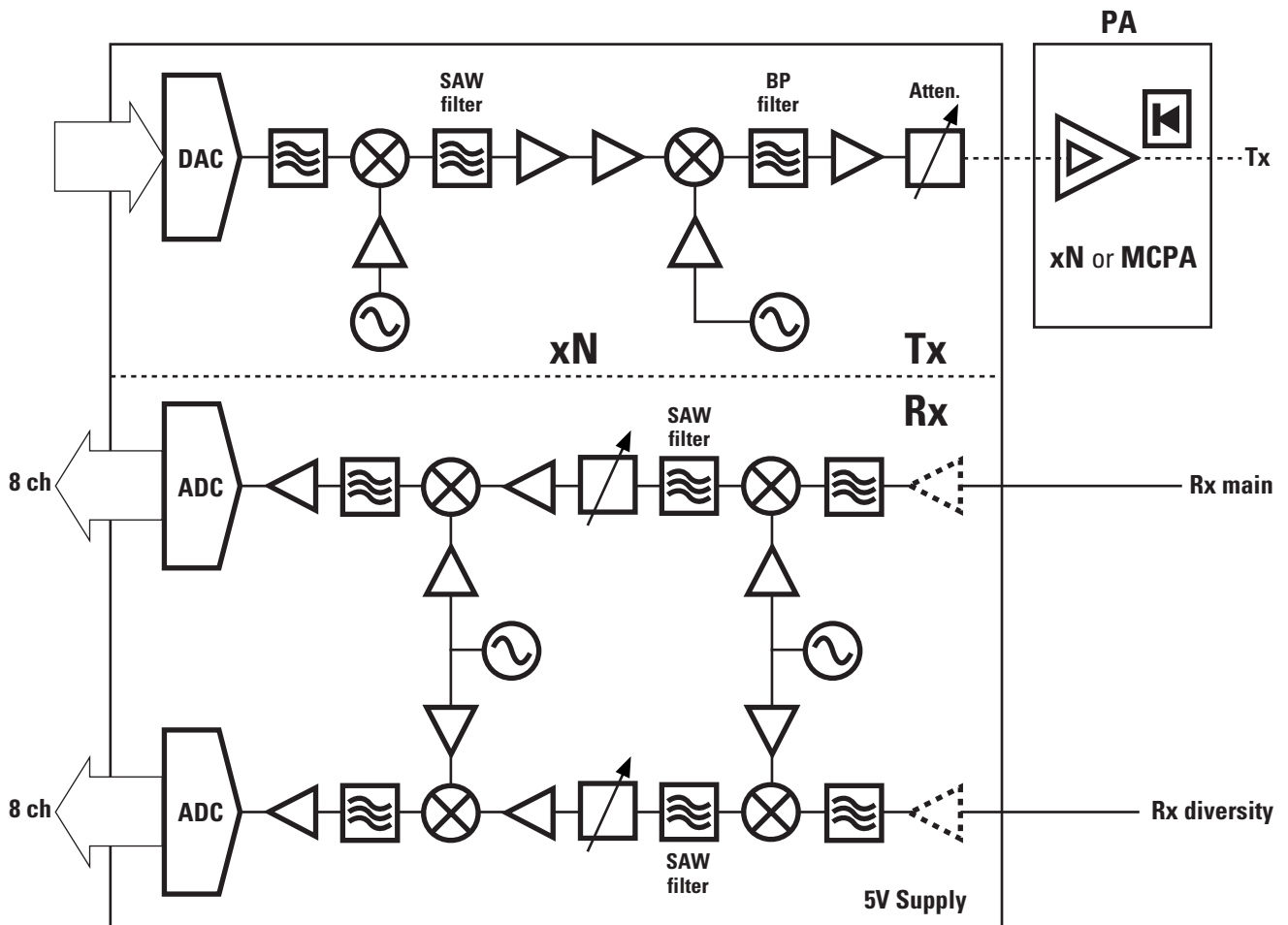
LO Buffer

- MGA-71543 GaAs MMIC
- ATF-551M4 FET E-pHEMT

* Not yet released – inquire through your local sales channel

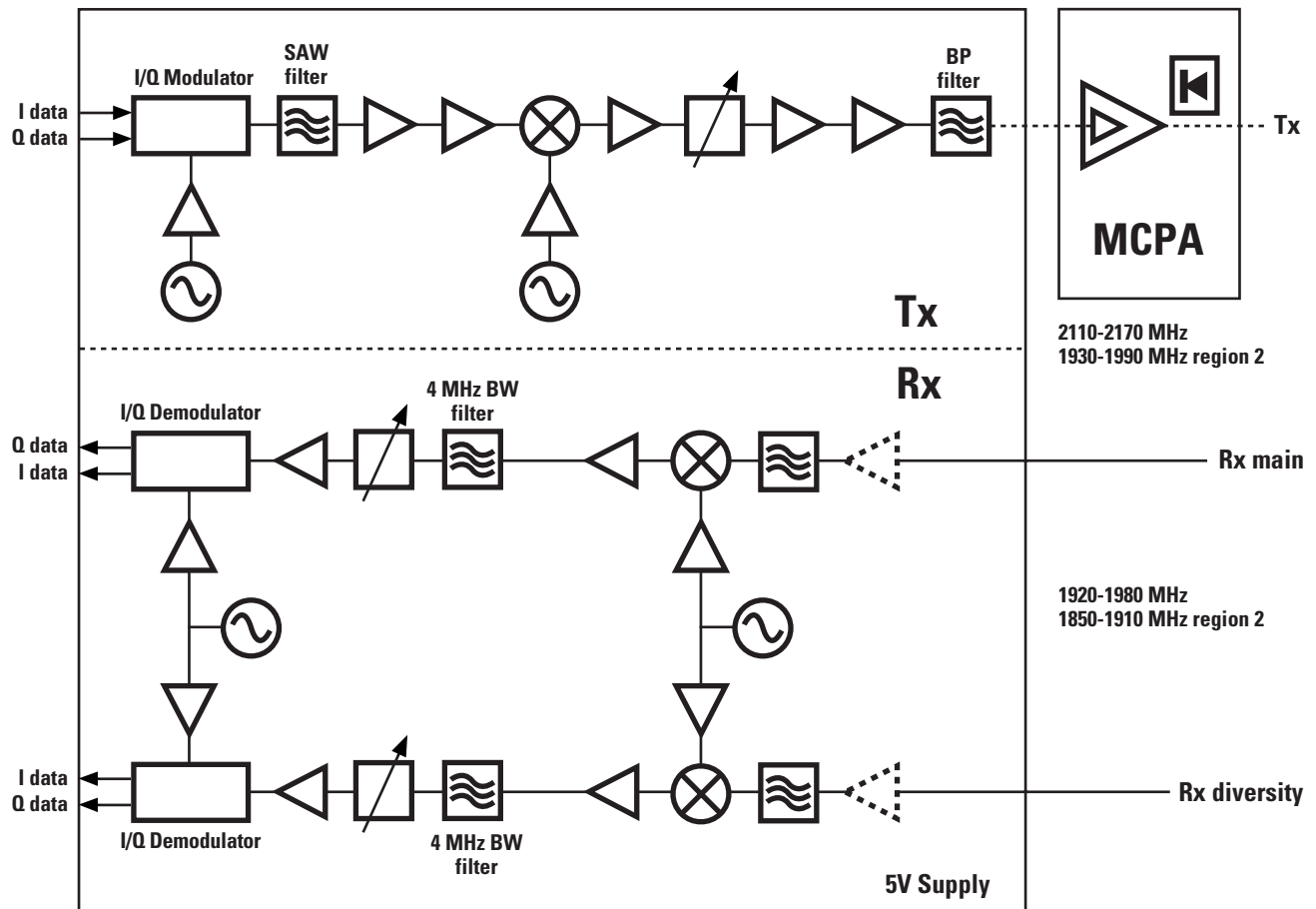
GSM Basestation Radio

Example



W-CDMA/CDMA Basestation Radio

Example



Basestation Radio

Suggested Components 1



IF Amplifier (Tx or Rx)

- MSA-XXXX MMIC Si
- MGA-81563/82563 MMIC GaAs
- AT-32032/41532 BJT Si



Tx RF Amplifier

- MGA-53543 MMIC E-pHEMT
- MGA-52543 MMIC GaAs
- MGA-81563/82563 MMIC GaAs
- MSA-XXXX MMIC Si
- ATF-54143/541M4 FET E-pHEMT
- HBFP-0420/0450 BJT Si



Detector

- HSMS-2825 Schottky SOT 143
- HSMS-282K Schottky SOT 363
- HSMS-2865 Schottky SOT 143 low Cj
- HSMS-286K Schottky SOT 363 low Cj

Basestation Radio

Suggested Components 2



LNA

- MGA-52543 MMIC GaAs
- MGA-53543 MMIC E-pHEMT
- MGA-81563/82563 MMIC GaAs
- ATF-54143/541M4 FET E-pHEMT
- ATF-34143/33143 FET
- MGA-71543/72543/725M4 MMIC GaAs



LO Buffer

- MSA-XXXX MMIC Si
- MGA-52543 MMIC GaAs
- MGA-81563/82563 MMIC GaAs
- MGA-85563/86563 MMIC Si, high S12

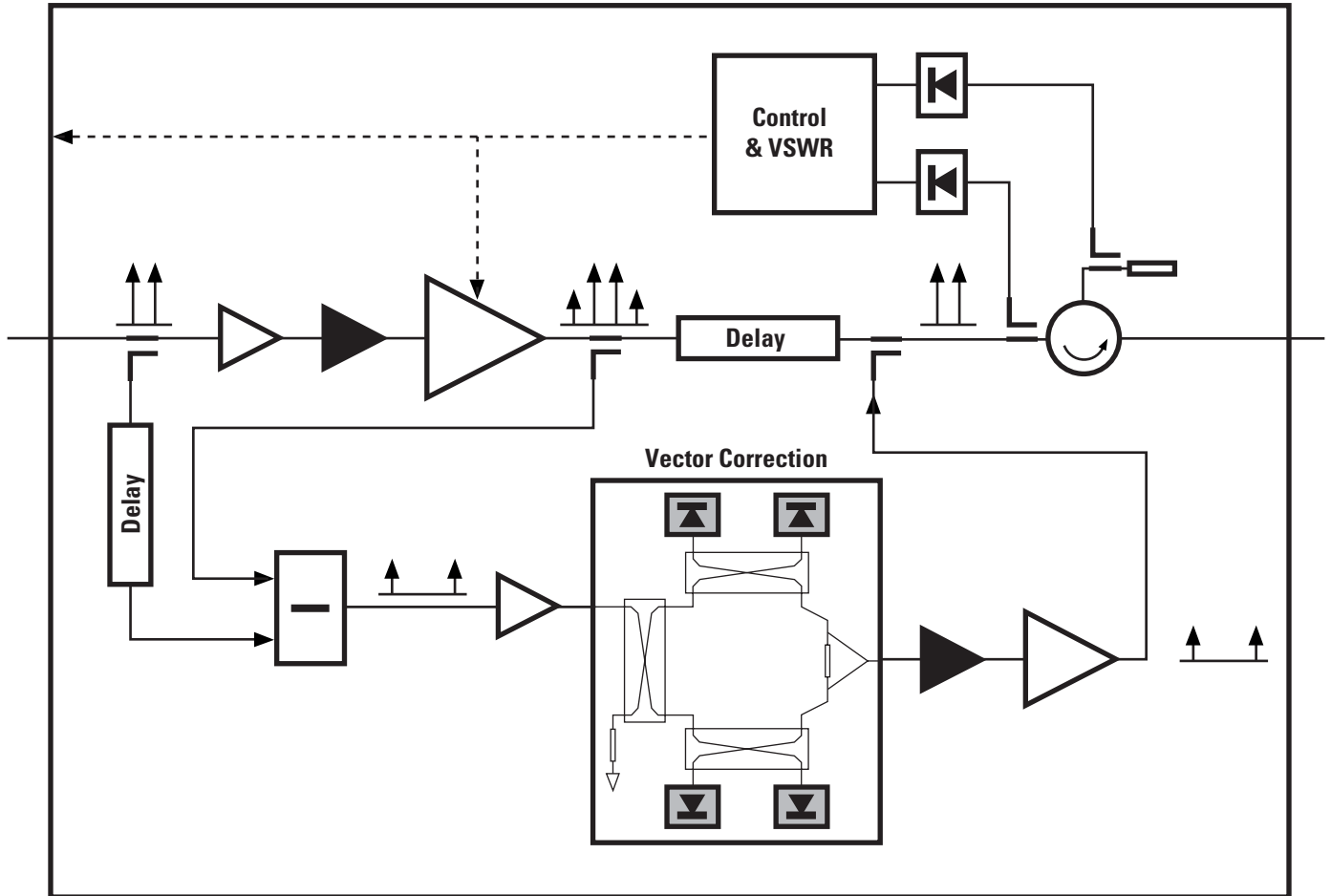


Variable Attenuator

- HSMP-381x PIN high linearity
- HSMP-386x PIN low cost
 - See application note AN1048

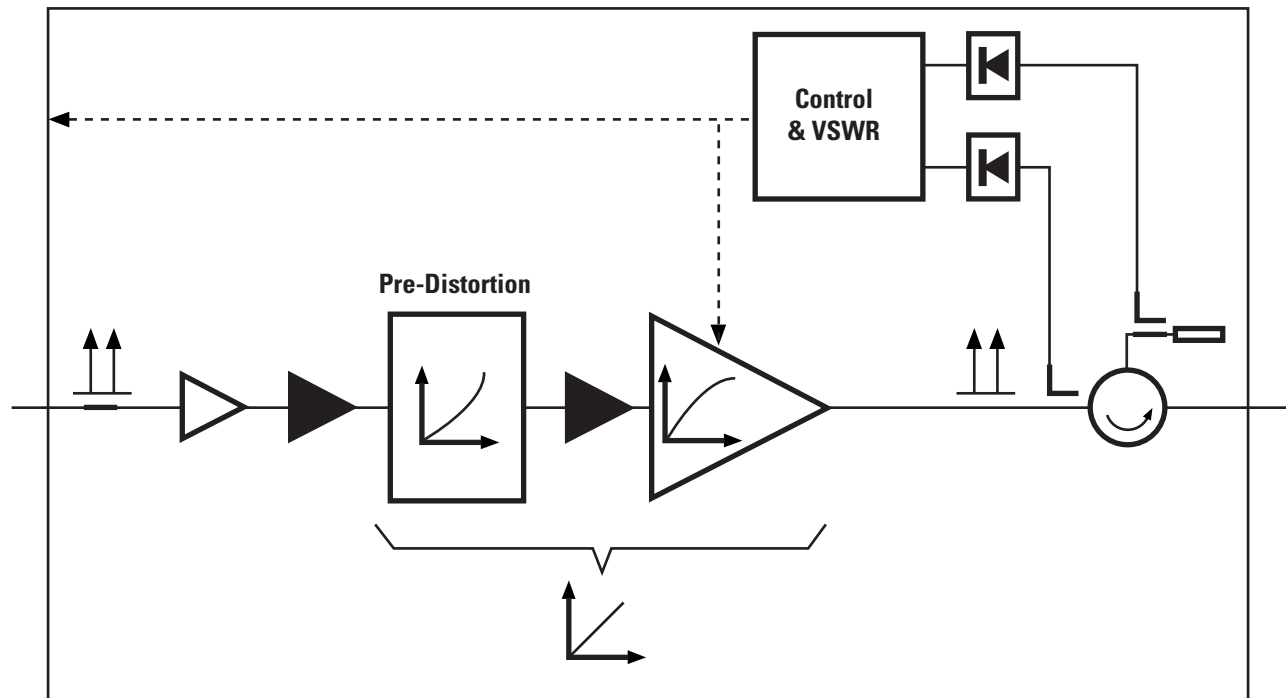
Multi-Carrier Power Amplifier

Feedforward Example



Multi-Carrier Power Amplifier

Pre-Distortion Example



Multi-Carrier Power Amplifier

Suggested Components 1



Tx Driver/Correction Path Amplifiers

- ATF-5x1P8 FET E-pHEMT*
- MGA-53543 MMIC GaAs
- MGA-81563/82563 MMIC GaAs
- ATF-54143/541M4 FET E-pHEMT

*Coming Soon



Detector

- HSMS-2825 Schottky SOT 143
- HSMS-282K Schottky SOT 363
- HSMS-2865 Schottky SOT 143 low Cj
- HSMS-286K Schottky SOT 363 low Cj

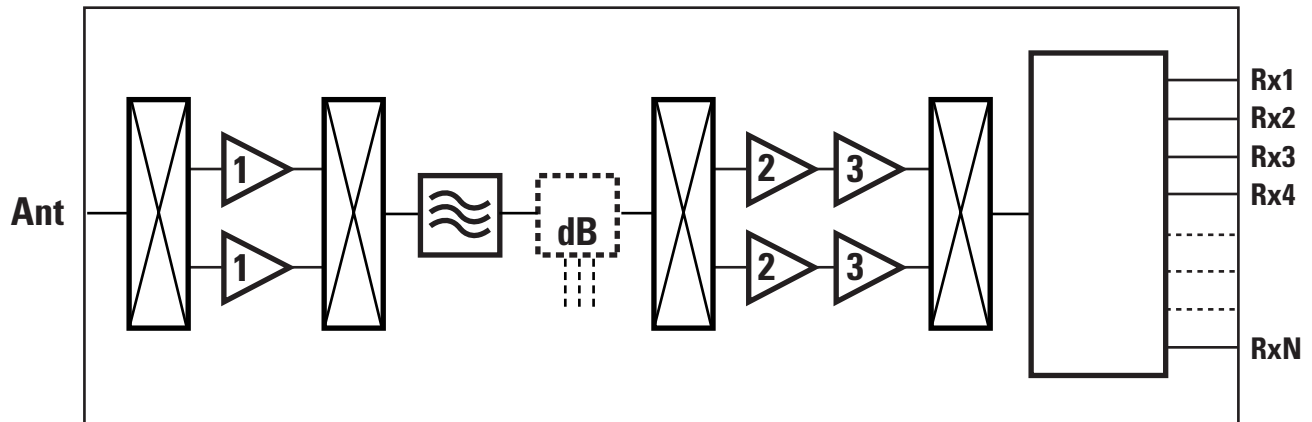


Vector Correction

- HSMP-4810 PIN low distortion

Basestation LNA/Multicoupler

Example



Q1: low noise

- ATF-54143/541M4 E-pHEMT
- ATF-55143/551M4 E-pHEMT
- ATF-34143 FET
- ATF-33143/331M4 FET
- ATF-35143/38143 FET



Q2: linearity/low noise

- ATF-5x1P8 FET E-pHEMT*
- ATF-54143/541M4 FET E-pHEMT
- ATF-33143/331M4 FET
- MGA-53543 MMIC E-pHEMT



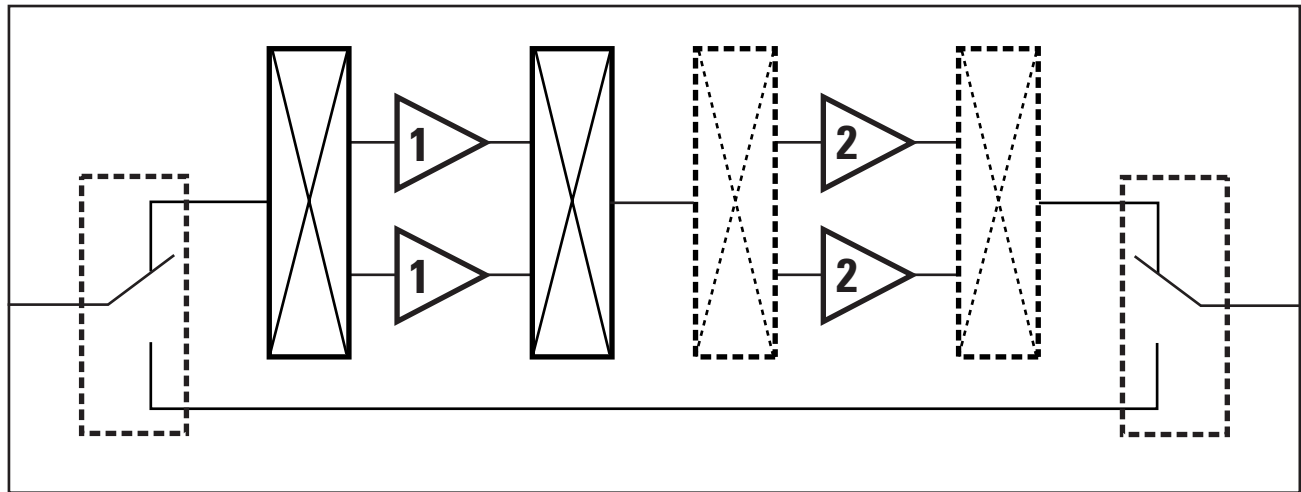
Q3: linearity

- ATF-5x1P8 FET E-pHEMT*
- ATF-54143/541M4 FET E-pHEMT
- MGA-53543 MMIC E-pHEMT

*Coming Soon

Tower Mounted Amplifier

Example



Bypass Switch

- HSMP-389x/489x PIN
- HMPP-389x PIN MiniPak
- HSMP-386x PIN
- HMPP-386x PIN MiniPak



Q1: low noise

- ATF-54143/541M4 FET E-pHEMT
- ATF-34143 FET
- ATF-33143/331M4 FET
- ATF-35143/38143 FET



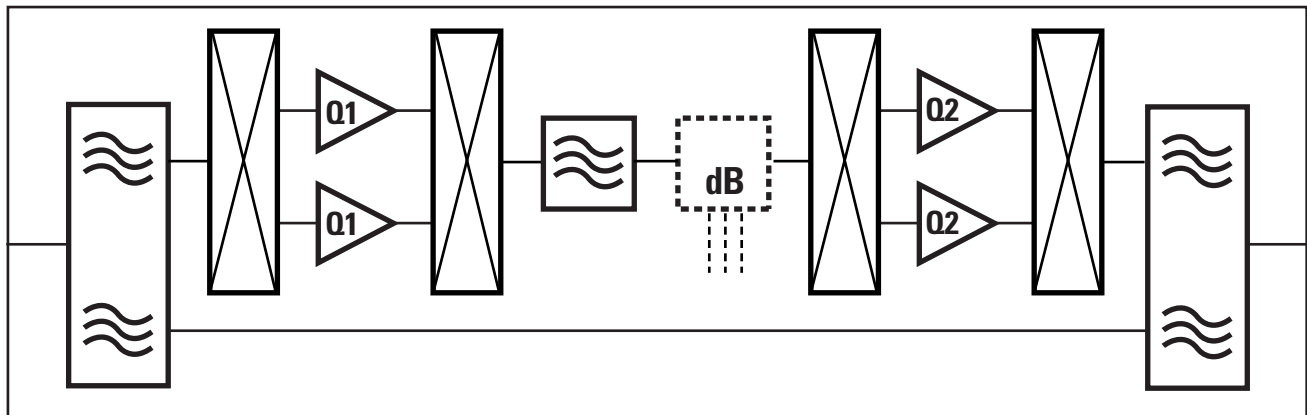
Q2: linearity/low noise

- ATF-5x1P8 FET E-pHEMT*
- ATF-54143/541M4 FET E-pHEMT
- ATF-33143/331M4 FET
- MGA-53543 MMIC E-pHEMT

* Coming Soon

Tower Mounted Amplifiers 2

Examples



Single or two stage. May not have duplex path.



Q1: low noise

- ATF-54143/541M4 FET E-pHEMT
- ATF-34143 FET
- ATF-33143/331M4 FET
- ATF-35143/38143 FET

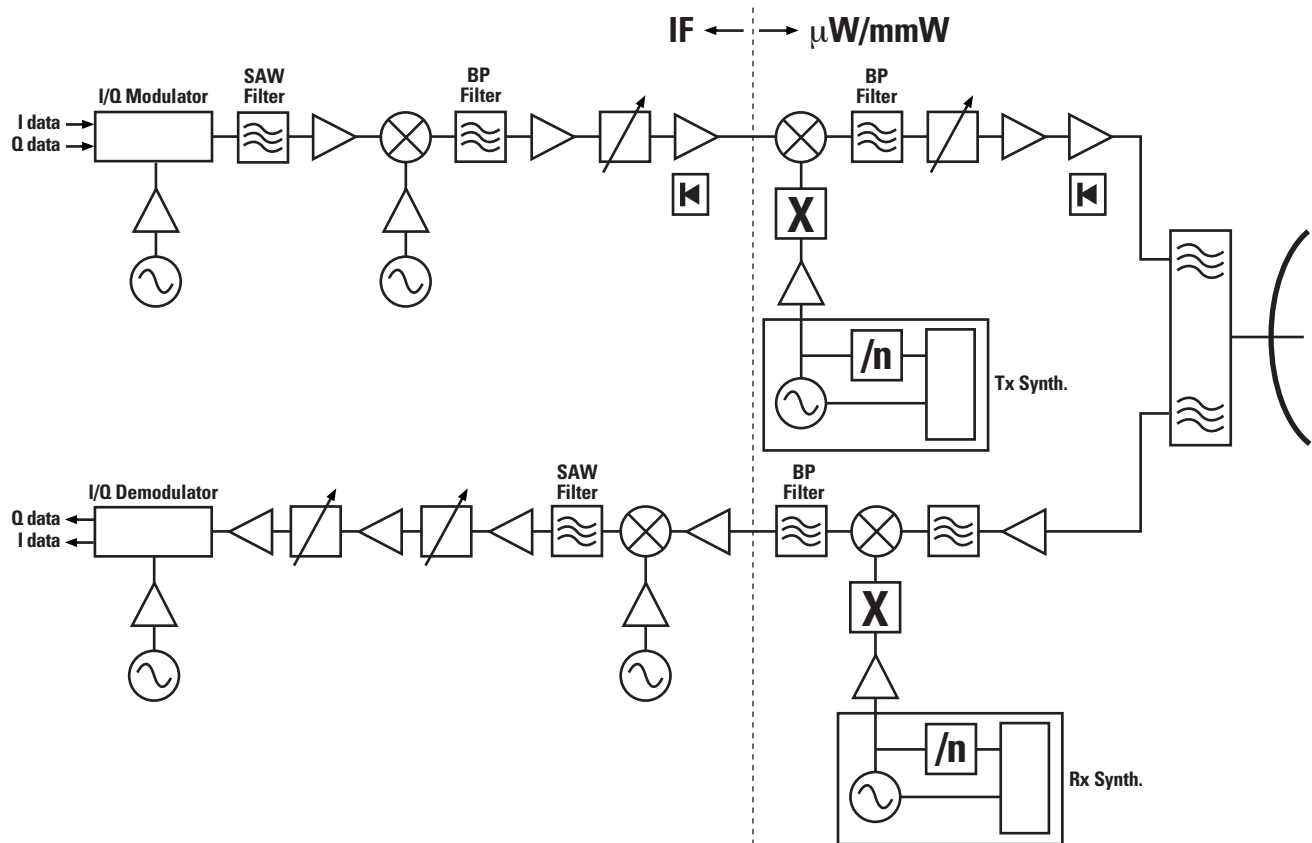


Q2: linearity/low noise

- ATF-5x1P8 FET E-pHEMT*
- ATF-54143/541M4 FET E-pHEMT
- ATF-33143/331M4 FET
- MGA-53543 MMIC E-pHEMT

*Coming Soon

Microwave Link



Microwave Link: IF Components

Suggested Components 1



IF Amplifiers & LO Buffers

- MSA-XXXX MMIC Si
- MGA-52543 MMIC GaAs
- MGA-81563/82563 MMIC GaAs
- AT-32032/41532 BJT Si



Detector

- HSMS-2825 Schottky SOT 143
- HSMS-282K Schottky SOT 363
- HSMS-2865 Schottky SOT 143 low Cj
- HSMS-286K Schottky SOT 363 low Cj



Variable Attenuator

(see application note AN1048)

- HSMP-381x PIN high linearity
- HSMP-386x PIN low cost

Microwave Link: μ W/mmW Components

Suggested Components 2



LNA

- HMMC-5023 MMIC GaAs
- HMMC-5038 MMIC GaAs



Variable Attenuator

- HMMC-1002 MMIC GaAs
 - HMMC-1015 MMIC GaAs
- high linearity



Prescaler

- HMMC-300x/302x MMIC GaAs
 - HMMC-310x/312x MMIC GaAs
- packaged



PA/PA Driver

- HMMC-5040 MMIC GaAs
- HMMC-5032/5033/5034 MMIC GaAs
- HMMC-5618 MMIC GaAs
- HMMC-5620 MMIC GaAs
- HMMC-5023 MMIC GaAs
- HMMC-5038 MMIC GaAs
- HMMC-5027 MMIC GaAs

Microwave Link: μ W/mmW Components cont.

Suggested Components 3



LO Buffer

- HMMC-5040 MMIC GaAs
- HMMC-5618 MMIC GaAs
- HMMC-5200 MMIC GaAs
- HMMC-3040 MMIC GaAs mixer



Multipliers

- HMMC-5040 MMIC GaAs
- HMMC-5023 MMIC GaAs (PN#11)
- HMMC-3040 MMIC GaAs mixer
- HSCH-9xxx Schottky GaAs



Mixer

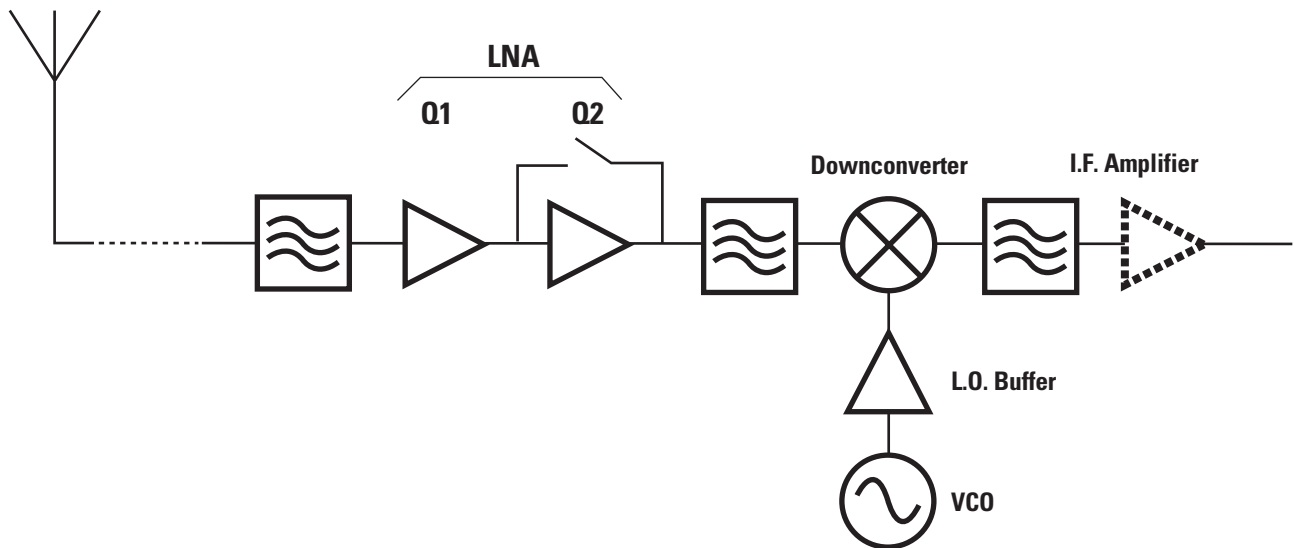
- HMMC-3040 MMIC GaAs mixer
- HSCH-9xxx Schottky GaAs



Detector

- HSCH-9161 GaAs Schottky beamlead
- HSCH-9401 GaAs Schottky bondpads
- HSCH-9101 GaAs Schottky beamlead

GPS Global Positioning System



GPS Global Positioning System

Suggested Components



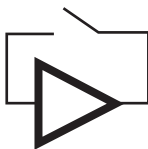
LNA Q1/Q2

- ATF-55143/551M4 FET E-pHEMT



Downconverter

- IAM-91563 GaAs MMIC



LNA Q2

- MGA-71543 GaAs MMIC
- MGA-72543/725M4 GaAs MMIC



LO Buffer

- MGA-71543 GaAs MMIC
- ATF-55143/551M4 FET E-pHEMT



IF Amplifier

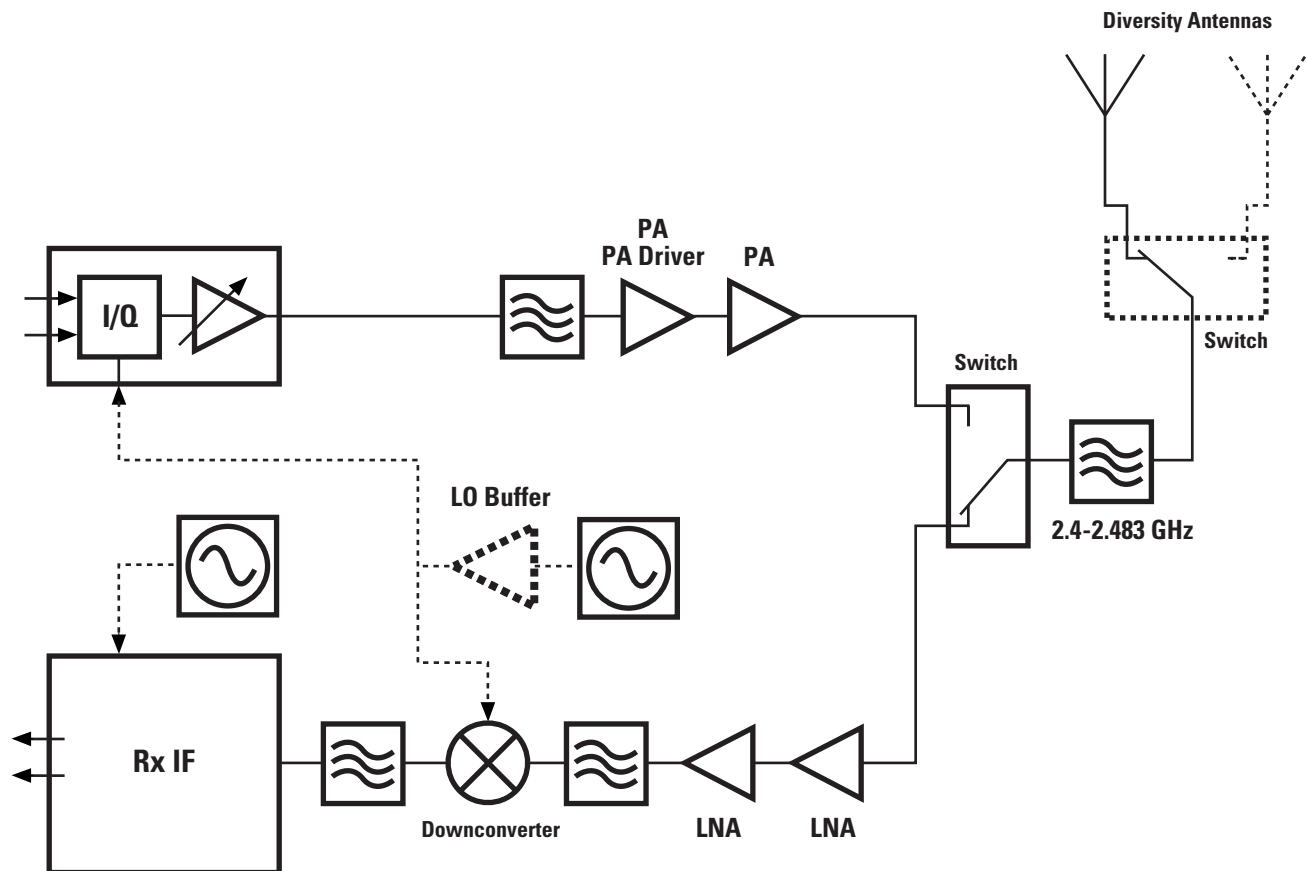
- MSA-2543/2643 MMIC Si
- MSA-XXXX MMIC Si



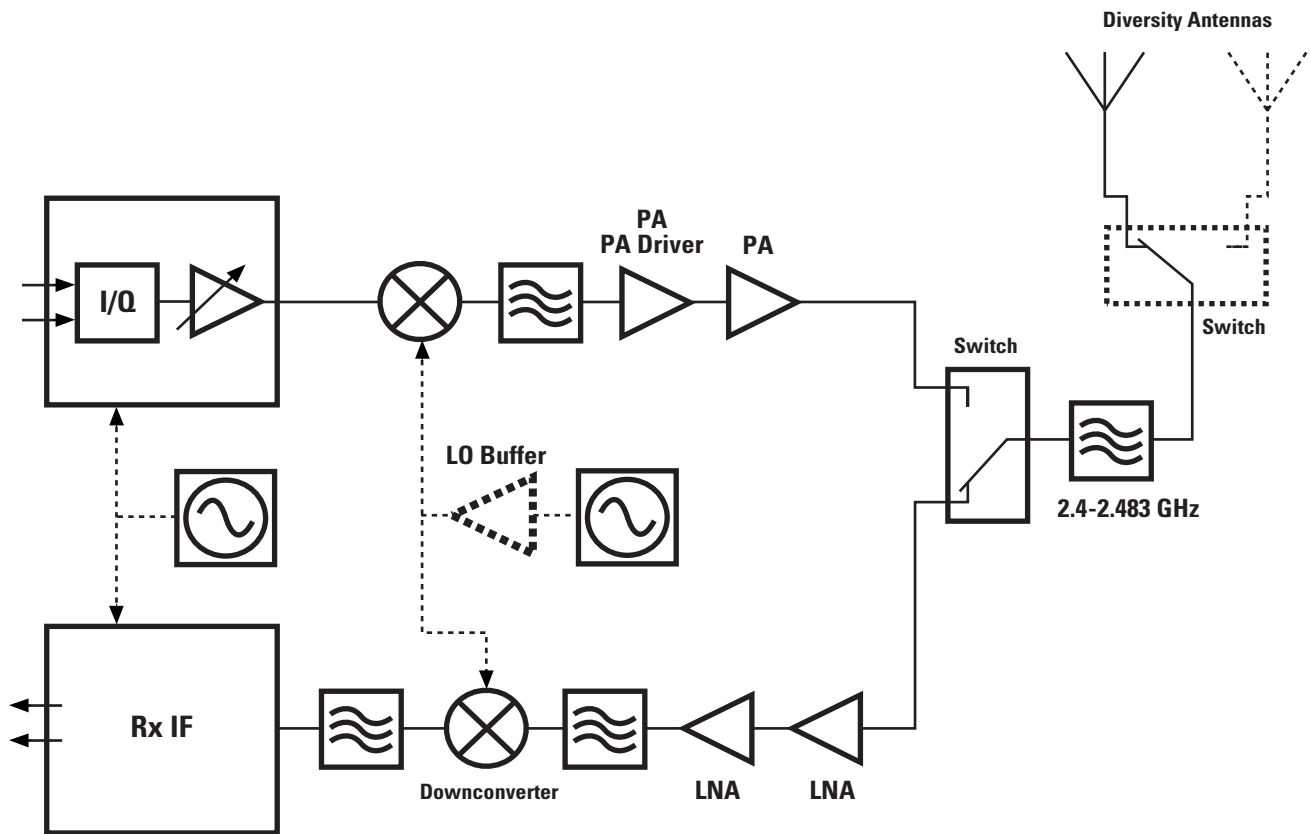
VCO

- AT-32032 BJT Si

2.4 GHz Systems r.f. modulation



2.4 GHz Systems i.f. modulation

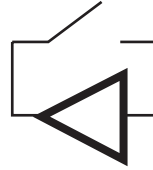


2.4 GHz Systems Suggested Components 1



PA

- MGA-83563 GaAs MMIC
- MGA-82563 GaAs MMIC
- ATF-51xP8 FET E-pHEMT*
- MGA-545P8 GaAs MMIC*



LNA with bypass

- MGA-71543 GaAs MMIC
- MGA-72543/725M4 GaAs MMIC



PA Driver

- MGA-81563 GaAs MMIC
- MGA-82563 GaAs MMIC
- MGA-71543 GaAs MMIC
- MGA-72543/725M4 GaAs MMIC
- MGA-545P8 GaAs MMIC*



LNA without bypass

- MGA-85563 GaAs MMIC
- MGA-87563 GaAs MMIC
- MGA-86563 GaAs MMIC
- ATF-55143/551M4 FET E-pHEMT

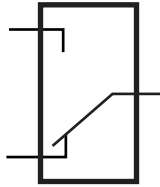
*Coming Soon

2.4 GHz Systems Suggested Components 2



Downconverter

- IAM-91563 GaAs MMIC



Switch: PIN

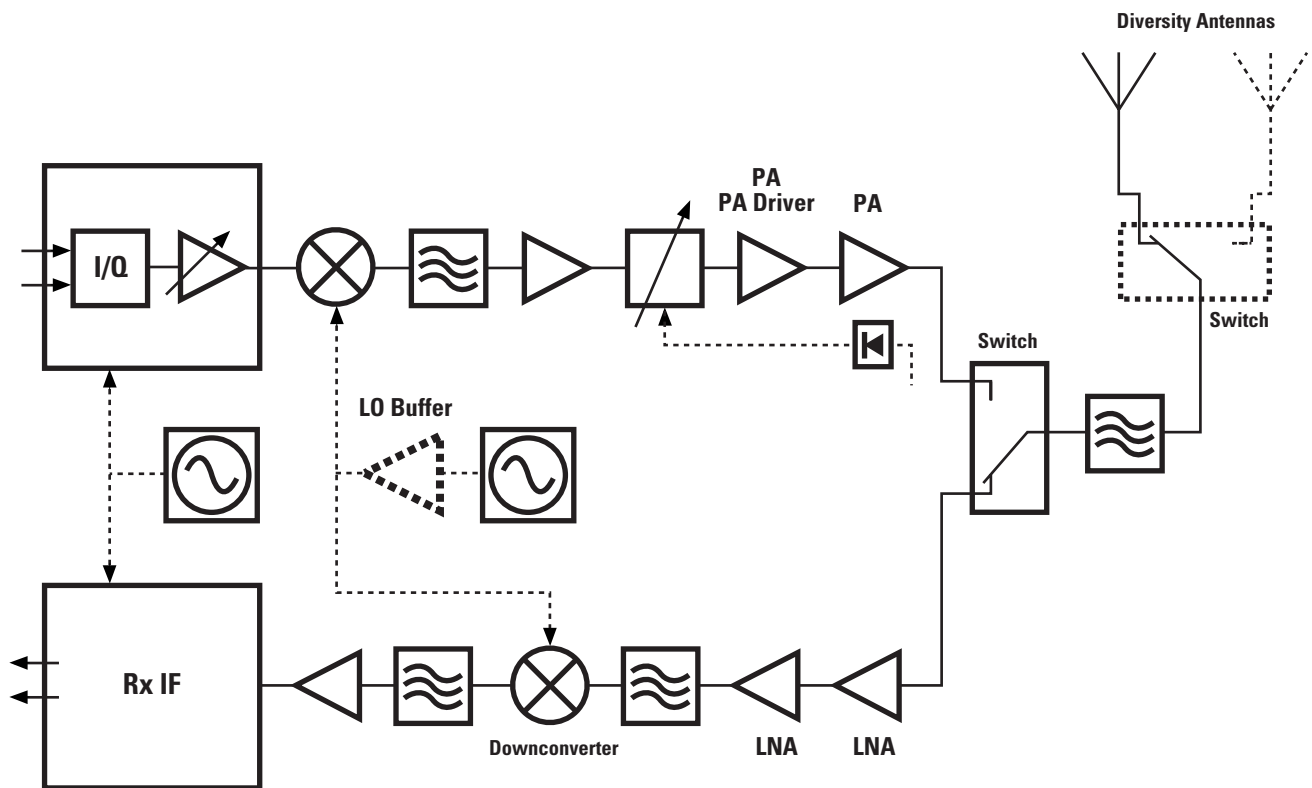
- HMPP-389x PIN MiniPak
- HSMP-389x PIN SOT 323/363



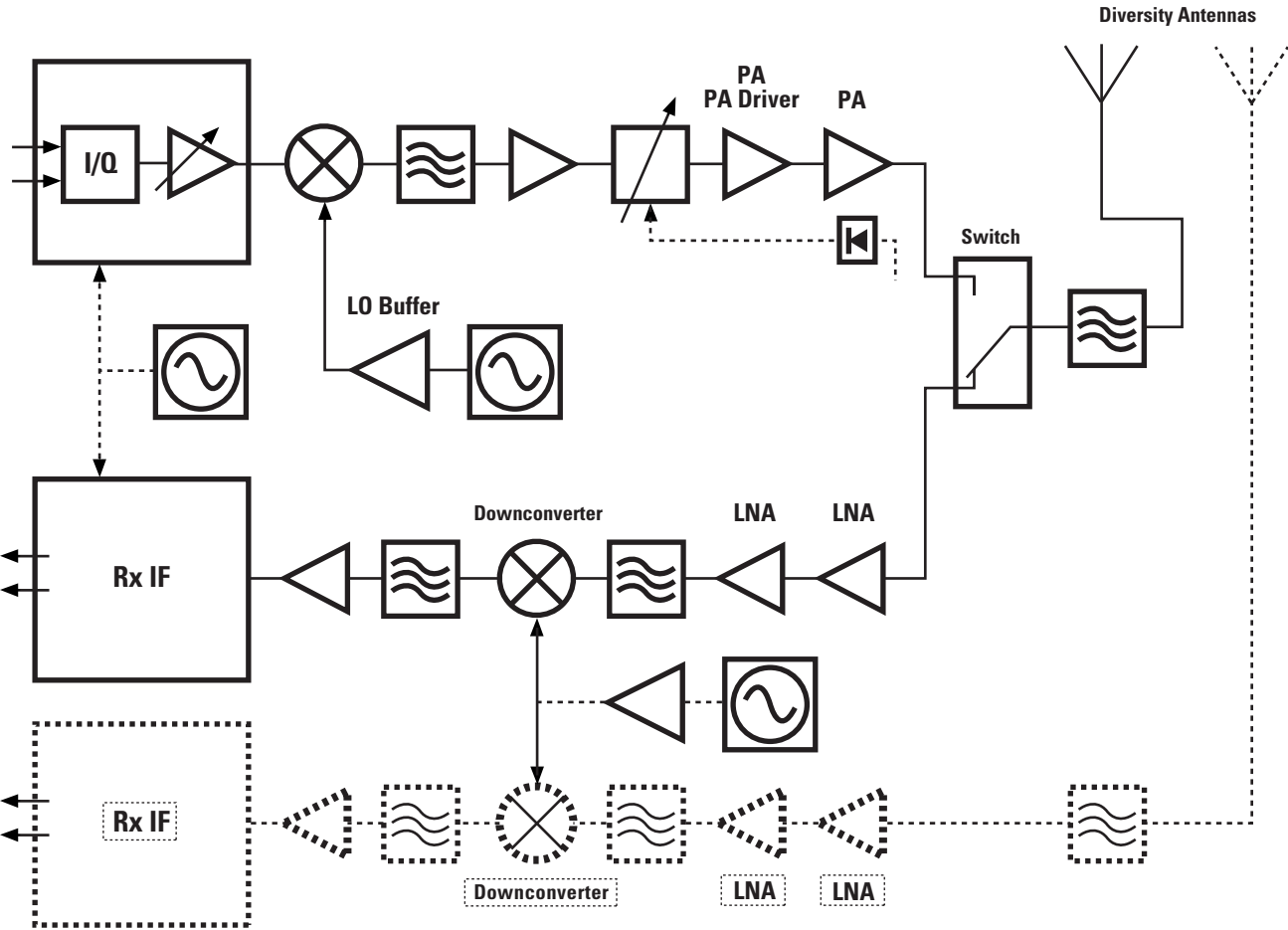
LO Buffer

- MGA-71543 GaAs MMIC
- MGA-85563 GaAs MMIC
- ATF-55143/551M4 FET E-pHEMT

3-4 GHz Systems Example 1



3-4 GHz Systems Example 2



3-4 GHz Systems Suggested Components 1



Tx Amplifiers and PA Drivers

- MGA-81563/82563 GaAs MMIC
- MGA-52543 GaAs MMIC
- MGA-71543 GaAs MMIC
- MGA-72543/725M4 GaAs MMIC
- MGA-545P8 GaAs MMIC*
- ATF-51xP8 FET E-pHEMT*



LNA with bypass

- MGA-71543 GaAs MMIC
- MGA-72543/725M4 GaAs MMIC



Mixers

- IAM-91563 GaAs MMIC
- HSMS-8202 Schottky Diode



LNA without bypass

- MGA-85563 GaAs MMIC
- MGA-86563 GaAs MMIC
- MGA-87563 GaAs MMIC
- ATF-55143/551M4 FET E-pHEMT
- ATF-35143 GaAs FET

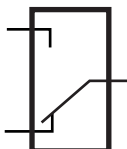
*Coming Soon

3-4 GHz Systems Suggested Components 2



Detector

- HSMS-2865/286K Schottky Pair



Switch: PIN

- HMPP-389x PIN MiniPak



IF Amplifiers

- MSA-XXXX MMIC Si
- MSA-81563/82563 GaAs MMIC



Attenuator: PIN

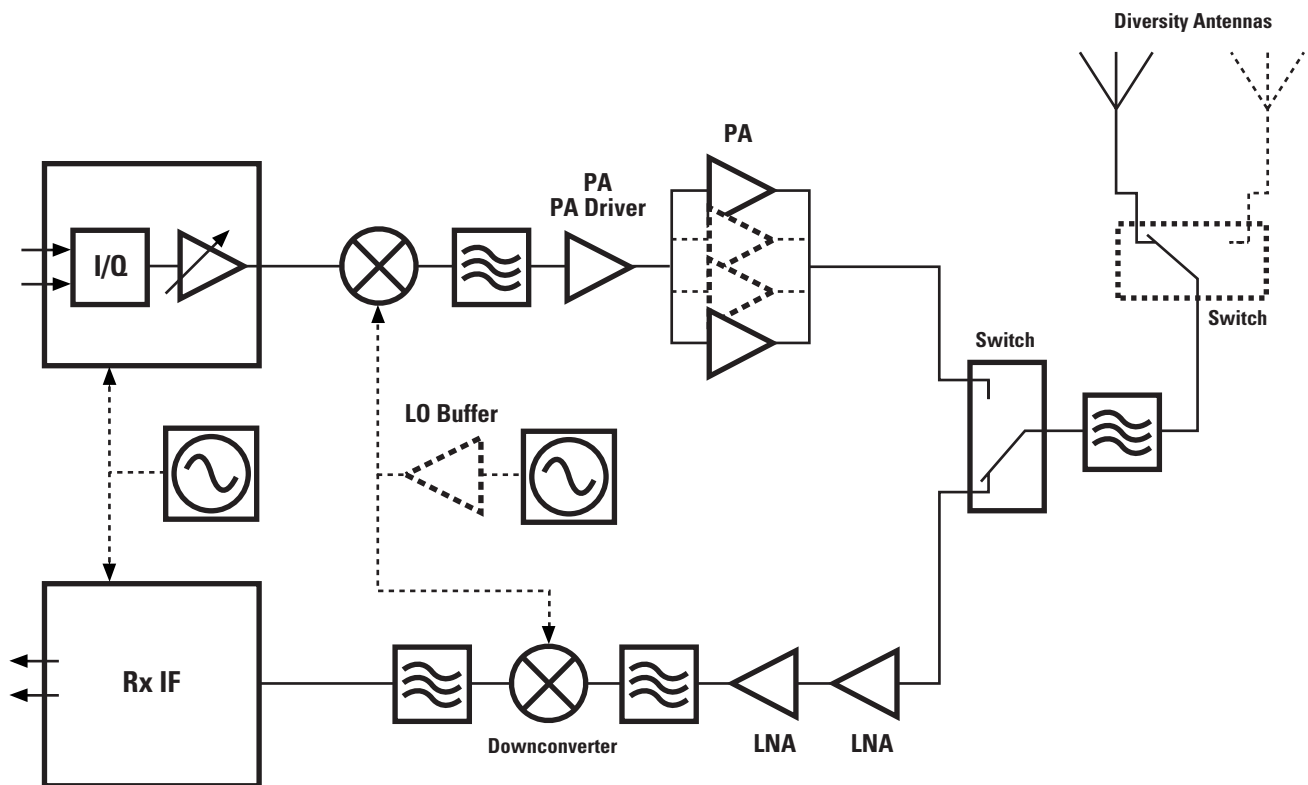
- HSMP-381x PIN SOT
(see application note AN1048)
- HMPP-386x PIN MiniPak



LO Buffer

- MGA-81563/82563 GaAs MMIC
- MGA-71543 GaAs MMIC
- MGA-85563 GaAs MMIC
- ATF-55143/551M4 FET E-pHEMT

5-6 GHz Systems



5-6 GHz Systems Suggested Components 1



PA

- MGA-82563 GaAs MMIC paralleled for power
- MGA-545P8 GaAs MMIC*



PA Driver

- MGA-81563 GaAs MMIC
- MGA-82563 GaAs MMIC
- ATF-54143/541M4 FET E-pHEMT
- MGA-71563 GaAs MMIC
- MGA-72563/725M4 GaAs MMIC



LNA without bypass

- MGA-85563 GaAs MMIC
- MGA-87563 GaAs MMIC
- MGAS-86563 GaAs MMIC
- ATF-55143/551M4 FET E-pHEMT

*Coming Soon

5-6 GHz Systems

Suggested Components 2



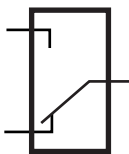
Downconverter

- IAM-91563 GaAs MMIC



LO Buffer

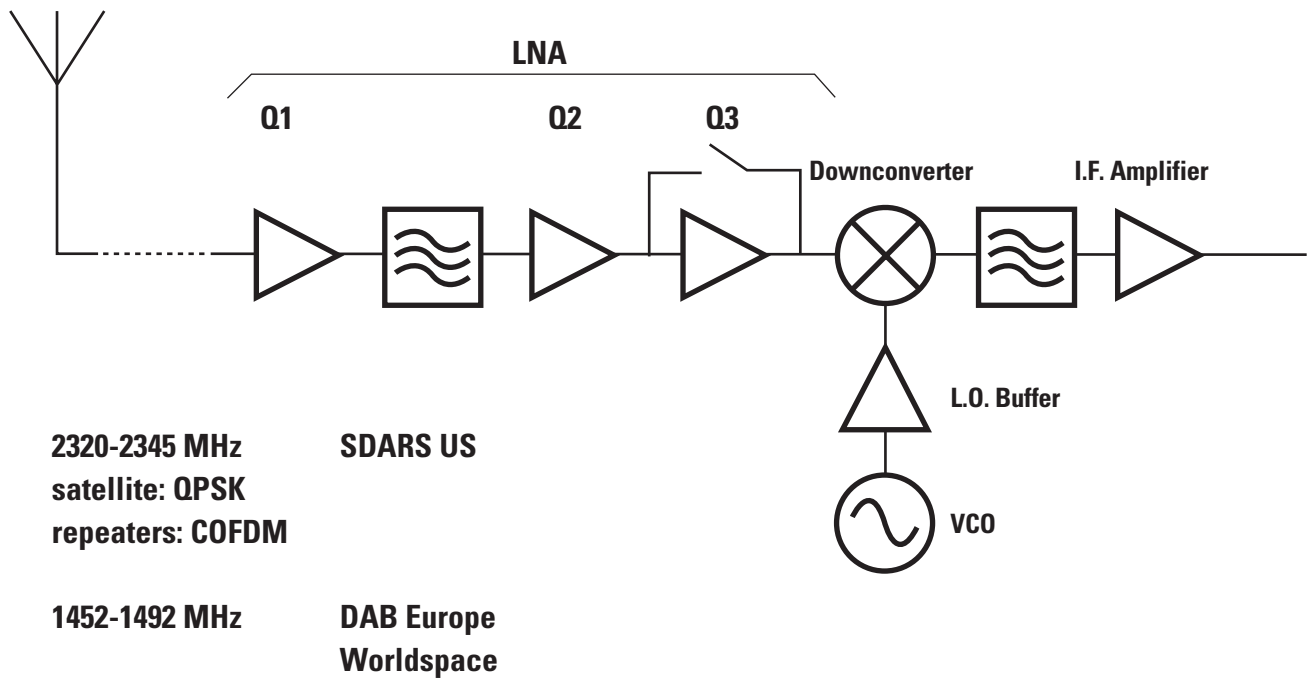
- MGA-81563 GaAs MMIC
- MGA-85563 GaAs MMIC
- ATF-54143/541M4 FET E-pHEMT



Switch: PIN

- HMPP-389x PIN MiniPak

SDARS Satellite Digital Audio Radio Services
DAB Digital Audio Broadcasting



SDARS Satellite Digital Audio Radio Services

DAB Digital Audio Broadcasting

Suggested Components



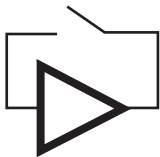
LNA Q1/Q2

- ATF-55143/551M4 FET E-pHEMT



Downconverter

- IAM-91563 MMIC GaAs



LNA Q3

- MGA-72543/725M4 GaAs MMIC
- MGA-71543 GaAs MMIC



LO Buffer

- MGA-71543 GaAs MMIC
- ATF-55143/551M4 FET E-pHEMT



IF Amplifier

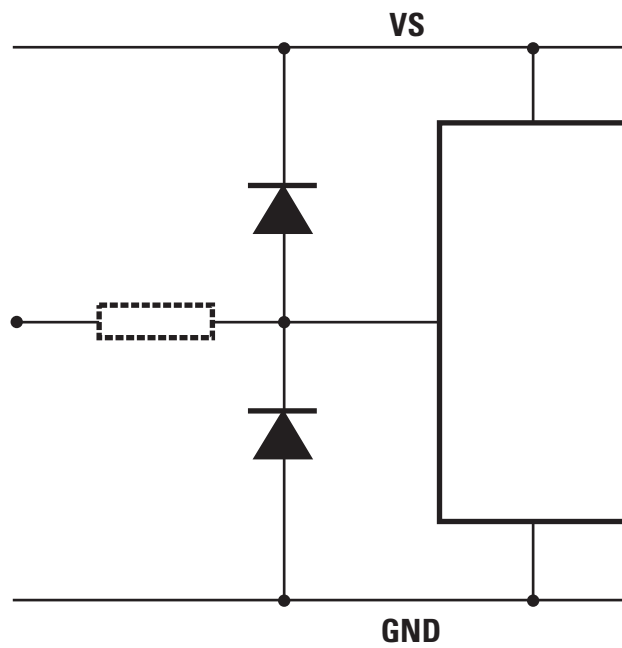
- MSA-2543/2643/2743 MMIC Si
- MSA-XXXX MMIC Si



VCO

- AT-32032 BJT Si
- AT-31033 BJT Si

Non-RF Input Protection



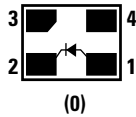
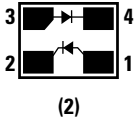
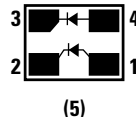
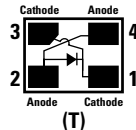
Protection Diodes

- HSMS-270x Schottky Diode Series
- HBAT-540x Schottky Diode Series
- HSMS-282x Schottky Diode Series

Surface Mount RF Diode

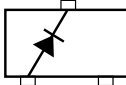
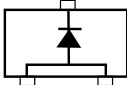
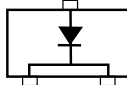
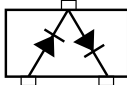
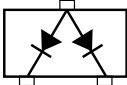
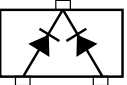
Product Selection

MiniPak

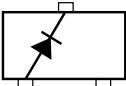
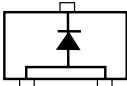
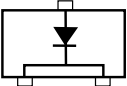
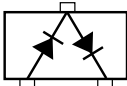
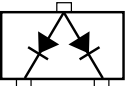
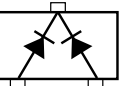
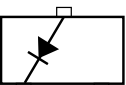
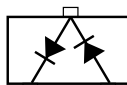
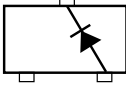
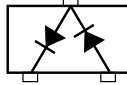
	Single	Anti-parallel	Parallel	Shunt Switch
Configuration				
PIN	HMPP-3860	HMPP-3862	HMPP-3865	
	HMPP-3890	HMPP-3892	HMPP-3895	HMPP-389T
	HMPS-2820	HMPS-2822	HMPS-2825	

Schottky

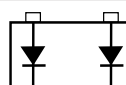
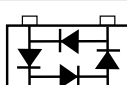
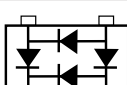
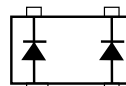
3 Lead Diodes SOT-323 (SC-70)

	Single	Dual Anode	Dual Cathode	Series Pair	Common Anode	Common Cathode
Configuration						
PIN	HSMP-381B		HSMP-481B	HSMP-381C	HSMP-381E	HSMP-381F
	HSMP-386B			HSMP-386C	HSMP-386E	HSMP-386F
	HSMP-389B	HSMP-489B		HSMP-389C	HSMP-389E	HSMP-389F
Schottky	HBAT-540B			HBAT-540C		
	HSMS-270B			HSMS-270C		
	HSMS-280B			HSMS-280C	HSMS-280E	HSMS-280F
	HSMS-281B			HSMS-281C	HSMS-281E	HSMS-281F
	HSMS-282B			HSMS-282C	HSMS-282E	HSMS-282F
	HSMS-285B			HSMS-285C		
	HSMS-286B			HSMS-286C	HSMS-286E	HSMS-286F

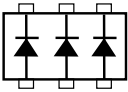
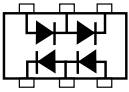
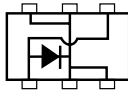
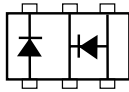
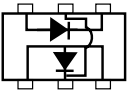
3 Lead Diodes SOT-23

	Single	Dual Anode	Dual Cathode	Series Pair	Common Anode	Common Cathode
Configuration						
PIN	HSMP-3810		HSMP-4810	HSMP-3812	HSMP-3813	HSMP-3814
	HSMP-3860			HSMP-3862	HSMP-3863	HSMP-3864
	HSMP-3890	HSMP-4890		HSMP-3892	HSMP-3893	HSMP-3894
Schottky	HBAT-5400			HBAT-5402		
	HSMS-2700			HSMS-2702		
	HSMS-2800			HSMS-2802	HSMS-2803	HSMS-2804
	HSMS-2810			HSMS-2812	HSMS-2813	HSMS-2814
	HSMS-2820			HSMS-2822	HSMS-2823	HSMS-2824
	HSMS-2860			HSMS-2862	HSMS-2863	HSMS-2864
						
	HSMS-2850			HSMS-2852		
						
	HSMS-8101			HSMS-8202		

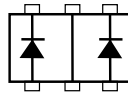
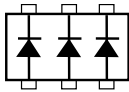
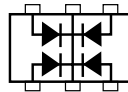
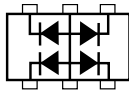
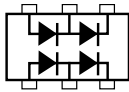
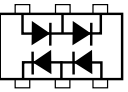
4 Lead Diodes SOT-143

	Unconnected Pair	Ring Quad	Bridge Quad	Crossover Quad
Configuration				
PIN	HSMP-3895			
Schottky	HSMS-2805		HSMS-2808	
	HSMS-2815	HSMS-2817	HSMS-2818	
	HSMS-2825	HSMS-2827	HSMS-2828	HSMS-2829
	HSMS-2865			
		HSMS-8207		HSMS-8209
				
	HSMS-2855			

6 Lead Diodes SOT-323 (SC-70)

	Unconnected Trio	Dual Mode Switch	Low Inductance	Series Shunt Pair	High Frequency Series Shunt Pair
Configuration	 L	 R	 T	 U	 V
PIN	HSMP-386L				
	HSMP-389L	HSMP-389R	HSMP-389T	HSMP-389U	HSMP-389V

6 Lead Diodes SOT-363 (SC-70)

	High Isolation Unconnected Pair	Unconnected Trio	Common Cathode Quad	Common Anode Quad	Bridge Quad	Ring Quad
Configuration	 K	 L	 M	 N	 P	 R
Schottky	HSMS-280K	HSMS-280L	HSMS-280M	HSMS-280N	HSMS-280P	HSMS-280R
	HSMS-281K	HSMS-281L				
	HSMS-282K	HSMS-282L	HSMS-282M	HSMS-282N	HSMS-282P	HSMS-282R
		HSMS-285L			HSMS-285P	
	HSMS-286K	HSMS-286L			HSMS-286P	HSMS-286R

PIN Diode

Application	Part Number	C_t (pF) (max/typ)	R_s (W) (max)	V_{BR} (V) (min)	T_{rr} (nS) (typ)	Lifetime (nS) (typ)
Low distortion attenuator	HSMP-381x	0.35/0.27	3.0	100	300	1500
Low distortion/low inductance attenuator	HSMP-481x	0.40/0.35	3.0	100	300	1500
Low inductance limiter	HSMP-482x	1.0/0.75	0.6	35	7	70
Low current switch/attenuator	HMPP/HSMP-386x	—/0.20	1.5 typ	50	80	500
Low resistance switch	HMPP/HSMP-389x	0.30/0.20	2.5	50	—	200
Low resistance/low inductance switch	HSMP-489x	0.38/0.33	2.5	50	—	200

Schottky-Barrier Diodes

Application	Part Number	V_{BR} (V) (min)	V_F (mV) (max)	$V_F @ I_F$ (V @ mA) (max)	C_t (pF) (typ)	R_D (W) (typ)	Volt. Sens. (g) (mV/mW) (typ @ 900 MHz)	R_V (KW) (typ)
Best overall general purpose	HMPS/HSMS-282x	15	340	0.7 @ 30	1.0	12.0	—	—
Clipping/Clamping	HBAT-540x	30	800	—	3.0	2.4	—	—
High Current Clipping/Clamping	HSMS-270x	15	550	—	6.7	0.65	—	—
Lowest flicker noise	HSMS-281x	20	400	1.0 @ 35	1.2	15	—	—
High V_{BR}	HSMS-280x	70	400	1.0 @ 15	2.0	35	—	—
Zero bias detector	HSMS-285x	—	150	—	0.3	—	40	8
High frequency up to 14 GHz	HSMS-286x	5	250	—	0.3	—	50	5

Agilent Microwave GaAs Beam Lead Schottky Diode

Selection Guide

Beam Lead GaAs Schottky Barrier Diodes

Part Number	Applications	C_{total} (pF)	R_s (Ω)	$B_v @ -10 \mu A$ (V)	$V_f @ 1 mA$ (mV)	Type
HSCH-9101	Microwave/Millimeter-wave Mixer	0.040	6	> 4.5	700	single
HSCH-9201	Microwave/Millimeter-wave Balanced Mixer	0.040	6	> 4.5	700	series pair
HSCH-9251	Microwave/Millimeter-wave Harmonic Mixer	0.040	6	> 4.5	700	antiparallel pair
HSCH-9301	Microwave/Millimeter-wave Double-Balanced Mixer	0.075	6	> 4.5	700	ring quad

Zero-Bias Beam Lead GaAs Detector Diodes

Part Number	Applications	C_j (pF)	R_v Max. (k Ω)	G (mV/ μW)	Functional through (GHz)
HSCH-9161	Microwave/Millimeter-wave Detector	0.035	7.5	0.5	110

Beamless GaAs Schottky Microwave/Millimeter-wave Diodes

Part Number	Applications	C_j (pF)	R_s (Ω)	$B_v @ -10 \mu A$ (V)	$V_f @ 1 mA$ (mV)	Type
HSCH-9401	Detector, single-ended mixer	0.015	<8.5	>6	700	Single
HSCH-9501	Balanced mixer	<0.05	<6	>4.5	700	Series pair
HSCH-9551	Harmonic mixer	<0.05	<6	—	700	Antiparallel pair

Agilent Technologies

Transistors

Selection Guide

Silicon Bipolar Transistors

NF_o and G_a are specified at a low noise bias point, while $P_{1\text{ dB}}$, $G_{1\text{ dB}}$, and $|S_{21E}|^2$ are specified at bias points which optimize these parameters.

Low Noise Transistors (Typical Specifications @ 25°C Case Temperature)

Part Number	Frequency (GHz)	V_{CE} (V)	NF_o (dB)	G_a (dB)	$P_{1\text{ dB}}$ (dBm)	$G_{1\text{ dB}}$ (dBm)	$ S_{21E} ^2$ @ 1.0 GHz (dB)	Package
AT-30511	0.9	2.7	1.1	16.0	+7.0	16.5	17.9 ^[1]	SOT-143 plastic SM
AT-30533	0.9	2.7	1.1	13.0	+7.0	15.0	15.2 ^[1]	SOT-23 plastic SM
AT-31011	0.9	2.7	0.9	13.0	+9.0	14.0	19.1 ^[1]	SOT-143 plastic SM
AT-31033	0.9	2.7	0.9	11.0	+9.0	12.0	15.8 ^[1]	SOT-23 plastic SM
AT-32011	0.9	2.7	1.0	14.0	+13.0	16.5	18.9 ^[1]	SOT-143 plastic SM
AT-32032	0.9	2.7	1.0	15.0	+13.0	15.5	11.5 ^[1]	SOT-323 plastic SM
AT-32033	0.9	2.7	1.0	12.5	+13.0	14.5	15.1 ^[1]	SOT-23 plastic SM
AT-32063 ^[2]	0.9	2.7	1.1	14.5	+12.0	16.0	17.0 ^[1]	SOT-363 plastic SM
AT-41411	2.0	8.0	1.8	13.0	+17.0	13.0	16.7	SOT-143 plastic SM
AT-41435	2.0	8.0	1.7	14.0	+19.0	14.0	17.2	micro-X SM
AT-41486	1.0	8.0	1.4	18.0	+18.0	13.5 ^[3]	17.5	85 mil plastic SM
AT-41511	0.9	5.0	1.0	15.5	+14.5	17.5	15.8 ^[1]	SOT-143 plastic SM
AT-41532	0.9	5.0	1.0	15.5	+14.5	14.5	13.3 ^[1]	SOT-323 plastic SM
AT-41533	0.9	5.0	1.0	14.5	+14.5	14.5	13.9 ^[1]	SOT-23 plastic SM
AT-41586	1.0	8.0	1.4	17.0	+18.0	13.0 ^[3]	17.0	85 mil plastic SM
AT-42036	2.0	8.0	1.9	13.5	+21.0	14.0	16.6	micro-X SM
AT-42070	2.0	8.0	1.9	14.0	+21.0	15.0	17.3	70 mil stripline
AT-42085	2.0	8.0	1.9	13.5	+20.5	14.0	17.0	85 mil plastic
AT-42086	2.0	8.0	1.9	13.0	+20.5	13.5	16.5	85 mil plastic SM

Notes:

1. Typical at 900 MHz

2. Dual transistor — All data is per individual transistor.

3. Typical $G_{1\text{ dB}}$ at 2 GHz

Silicon Bipolar Transistors, continued

Medium Power Transistors (Typical Specifications @ 25°C Case Temperature)

Part Number	V _{CE} (V)	P _{1dB} @ 2 GHz (dBm)	G _{1dB} @ 2 GHz (dBm)	P _{1dB} @ 4 GHz (dBm)	G _{1dB} @ 4 GHz (dBm)	Package
AT-64020	16.0	+28	10.0	+27	6.5	200 mil BeO disk

Gallium Arsenide (GaAs) Field Effect Transistors (FETs)

NF_o and G_a are specified at a low noise bias point, while P_{1dB} and G_{1dB} are specified at bias points which optimize these parameters.

Single Voltage Low Noise E-pHEMTs^[1] (Typical Specifications @ 25°C Case Temperature)

Part Number	Gate Width (μm)	Frequency Range (GHz)	Test Freq. (GHz)	V _{dd} (V)	I _{dd} (mA)	NF _o (dB)	G _a (dB)	OIP3 (dBm)	P _{1dB} (dBm)	Package
ATF-511P8	6400	0.05 - 6	2	4.5	200	2.5	15.5	43	+30.4	LPCC ^[3]
ATF-521P8	3200	0.05 - 6	2	4.5	200	1.5	17.0	42	+26.5	LPCC ^[3]
ATF-531P8	1600	0.05 - 6	2	4.0	135	0.6	20.0	38	+24.5	LPCC ^[3]
ATF-54143	800	0.45 - 6	2	3	60	0.5	16.6	36.2	+20	SOT-343 (SC-70)
ATF-541M4	800	0.45 - 10	2	3	60	0.5	17.5	35.8	+21	MiniPak ^[2]
ATF-55143	400	0.45 - 6	2	2.7	10	0.6	17.7	24.2	+14	SOT-343 (SC-70)
ATF-551M4	400	0.45 - 10	2	2.7	10	0.5	17.5	24.1	+15	MiniPak ^[2]

Low Noise pHEMTs (Typical Specifications @ 25°C Case Temperature)

Part Number	Gate Width (μm)	Frequency Range (GHz)	Test Freq. (GHz)	V _{dd} (V)	I _{dd} (mA)	NF _o (dB)	G _a (dB)	OIP3 (dBm)	P _{1dB} (dBm)	Package
ATF-33143	1600	0.45 - 6	2	4	80	0.5	15.0	33.5	+22	SOT-343 (SC-70)
ATF-331M4	1600	0.45 - 6	2	4	60	0.6	15.0	31	+19	MiniPak ^[2]
ATF-34143	800	0.45 - 6	2	4	60	0.5	17.5	31.5	+20	SOT-343 (SC-70)
ATF-35143	400	0.45 - 6	2	2	15	0.4	18.0	21	+10	SOT-343 (SC-70)
ATF-38143	800	0.45 - 6	2	2	10	0.4	16.0	22	+12	SOT-343 (SC-70)
ATF-36077	200	1.5 - 18	12	1.5	10	0.5	12.0	—	+5	70 mil SM
ATF-36163	200	1.5 - 18	12	1.5	15	1.2	10.0	—	+5	SOT-363 (SC-70)

Notes:

1. Agilent's enhancement mode E-pHEMT devices are the first commercially available single-supply GaAs transistors that do not need a negative gate bias voltage for operation. They can help simplify the design and reduce the cost of receivers and transmitters in many RF applications.
2. MiniPak is a thin miniature packaging with the following dimension: 1.4 mm (L) x 1.2 mm (W) x 0.7 mm (D)
3. LPCC (Leadless Plastic Chip Carrier) is a copper leadframe based plastic molded package with the following dimensions: 2.0 mm (L) x 2.0 mm (W) x 0.75 mm (D)

Agilent RFIC

Selection Guide

GaAs Fixed Gain Amplifiers

	Part Number	Frequency Range (GHz)	Test Freq (GHz)	V_{dd} (V)	I_{dd} (mA)	NF (dB)	Gain (dB)	P_{1dB} (dBm)	OIP_3 (dBm)	Package
New!	MGA-52543	0.4 – 6	1.9	5	53	1.9	14.2	+17.4	+31.7 ^[3]	SOT-343 (SC-70)
	MGA-53543	0.4 – 6	1.9	5	54	1.5	15.4	+18.6	+39.1	SOT-343 (SC-70)
New!	MGA-81563	0.1 – 6	2	3	42	2.8	12.4	+14.8	+27	SOT-363 (SC-70)
	MGA-82563	0.1 – 6	2	3	84	2.2	13.2	+17.3	+31	SOT-363 (SC-70)
	MGA-85563	0.8 – 6	2	3	15 to 30 ^[1]	1.9	19	+1 to +8	+12 to +17	SOT-363 (SC-70)
	MGA-86563	0.5 – 6	2.4	5	14	1.6	22.5	+4.2	+15	SOT-363 (SC-70)
	MGA-86576	1.5 – 8	4	5	16	2.0	23.1	+6.3	+16	SM Ceramic
	MGA-87563	0.5 – 4	2.4	3	4.5	1.6	12.5	-2	+8	SOT-363 (SC-70)

GaAs Medium Power Amplifier

Part Number	Frequency Range (GHz)	Test Freq (GHz)	V_{dd} (V)	I_{dd} (mA)	PSAT (dBm)	PAE (%)	Gain (dB)	Package
MGA-83563	0.5 – 6	2.4	3	152	22	37	23	SOT-363 (SC-70)

GaAs Amplifier with Bypass Switch

	Part Number	Frequency Range (GHz)	Test Freq (GHz)	NF (dB)	Gain (dB)	IIP_3 (dBm @ mA)	Switch IL (dB)	Switch Isolation (dB)	Supply Voltage (V)	Supply Current (mA)	Package
New!	MGA-71543	0.1 – 6.0	2	0.8	15.4	+7.4 @ 20	2.5	-22.5	2.7 – 4.2	0 to 60 ^[1]	SOT-343 (SC-70)
	MGA-72543	0.1 – 6.0	2	1.4	13.6	+10.5 @ 20	2.5	-23.2	2.7 – 4.2	0 to 60 ^[1]	SOT-343 (SC-70)
New!	MGA-725M4	0.1 – 6.0	2	1.3	15.7	+9.9 @ 20	1.6	-23.4	2.7 – 4.2	0 to 60 ^[1]	MiniPak
	Package ^[2]										

Notes:

1. Supply current can be adjusted using an external resistor to vary P_{1dB} and IIP_3
 2. MiniPak dimension: 1.4 mm (L) x 1.2 mm (W) x 0.7 mm (D)
 3. IIP_3 of MGA-52543 is 17.5 dBm at 1.9 GHz
- All specifications are typical at +25°C case temperature

Silicon Fixed Gain Amplifiers

Part Number	Frequency Range (GHz)	NF (dB @ 2 GHz)	Gain (dB @ 2 GHz)	P _{1dB} (dBm @ 2 GHz)	IP ₃ (dBm @ 2 GHz)	Supply Voltage (V)	Supply Current (mA)	Package
MSA-2543	DC – 3.0	4.5	13.8	0	13 (Output)	5	12	SOT-343 (SC-70)
MSA-2643	DC – 3.0	3.6	15.9	9.4	21.9 (Output)	5	27	SOT-343 (SC-70)
MSA-2743	DC – 3.0	4	15.5	15	28 (Output)	5	50	SOT-343 (SC-70)

Part Number	Frequency Range (GHz)	NF @ 1 GHz (dB)	Gain @ 0.1 GHz (dB)	Gain @ 1 GHz (dB)	P _{1dB} (dBm)	IP ₃ (dBm)	V _{CC} MIN (V)	Device Voltage (V)	Device Current (mA)	Package
MSA-2111	DC – 500	3.3	22.0	16.0	+10	+20	5	3.6	29	SOT-143
MSA-0836 X	DC – 4000	3.0	32.5	23.0	+12.5	+27	10	7.8	36	trim lead micro-
MSA-0870	DC – 4000	3.0	32.5	23.5	+12.5	+27	10	7.8	36	70 mil stripline
MSA-0886 plastic	DC – 4000	3.3	32.5	22.5	+12.5	+27	10	7.8	36	85 mil SM
MSA-3111	DC – 500	3.5	24.4	18.4	+9	+23	7	4.5	29	SOT-143
MSA-3186 plastic	DC – 500	3.5	24.6	18.7	+9	+21	7	4.7	29	85 mil SM
MSA-2011	DC – 1000	4.3	18.9	16.2	+9	+22	7	5.0	32	SOT-143
MSA-2086 plastic	DC – 1100	3.7	19.2	16.6	+9	+22	7	5.0	32	85 mil SM
MSA-0711	DC – 1900	5.0	13.0	12.0	+5.5	+18	5	3.8	22	SOT-143
MSA-0770	DC – 2500	4.5	13.5	13.0	+5.5	+19	5	4.0	22	70 mil stripline
MSA-0785	DC – 2000	5.0	13.5	12.5	+5.5	+19	5	4.0	22	85 mil plastic
MSA-0786 plastic	DC – 2000	5.0	13.5	12.5	+5.5	+19	5	4.0	22	85 mil SM
MSA-0986 plastic	50 – 5500	6.0	8.0	7.5	+11.5	+23	12	7.8	35	85 mil SM
MSA-0236 X	DC – 2700	6.5	12.5	12.0	+4.5	+17	7	5.0	25	trim lead micro-
MSA-0270	DC – 2800	6.5	12.5	12.0	+4.5	+17	7	5.0	25	70 mil stripline
MSA-0286 plastic	DC – 2500	6.5	12.5	12.0	+4.5	+17	7	5.0	25	85 mil SM
MSA-0420	DC – 4000	6.5	8.5	8.5	+16	+30	10	6.3	90	200 mil BeO disk
MSA-0436 X	DC – 3800	6.5	8.5	8.3	+12.5	+25.5	7	5.3	50	trim lead micro-
MSA-0470	DC – 4000	6.5	8.5	8.3	+12.5	+25.5	7	5.3	50	70 mil stripline
MSA-0486 plastic	DC – 3200	7.0	8.3	8.0	+12.5	+25.5	7	5.3	50	85 mil SM
MSA-0505 plastic	20 – 2300	6.5	8.0	7.0	+18	+29	12	8.4	80	85 mil SM
MSA-0520	20 – 2800	6.5	9.0	8.5	+23	+33	15	12.0	165	200 mil BeO disk
MSA-9970 (open loop)	DC – 2000	—	17.5	16.0	+14.5	+25	10	7.8	35	70 mil stripline

Mixers – Downconverters

Part Number	Description	RF & LO Freq Range (GHz)	IF Freq Range (MHz)	NF (dB)	Conversion Gain (dB)	Input IP ₃ (dBm)	Supply Voltage (V)	Supply Current (mA)	Test Frequencies	Package
IAM-91563	GaAs	0.8 – 6	50 – 700	8.5	9	-6	3	9	RF input: 1.9 GHz LO input: 1.64 GHz IF input: 250 MHz	SOT-363 (SC-70)

Agilent mmW MMIC

Selection Guide

GaAs MMIC Low Noise Amplifiers

Part Number	Frequency Range (GHz)	Bias Cond. (V @ mA)	Gain (dB)	P _{1dB} (dBm)	NF (dB)	Package
HMMC-5023	21.2 – 26.5	5 @ 24	24	+14	2.5 ^[1]	chip
HMMC-5038	37 – 40	3 @ 120	23	+12	4.8	chip

Note:

1. Typ. 21.2–23.6 GHz; 2.8 typ. 24.5–26.5 GHz.

GaAs MMIC Broadband Medium-Power Amplifiers

Part Number	Description & Features	Freq. Range (GHz)	Bias Cond. (V @ mA)	Gain (dB)	Gain Flatness (dB)	P _{1dB} (dBm)	Package
HMMC-5021	distributed amplifier with low-frequency extension capabilities	2 – 22.0	7 @ 150	8	± 1	+17.5	chip
HMMC-5022	distributed amplifier with low-frequency extension capabilities	2 – 22.0	7 @ 150	9.5	± 1	+17.5	chip
HMMC-5026	distributed amplifier with low-frequency extension capabilities	2 – 26.5	7 @ 150	7.5	± 1	+15	chip
HMMC-5027	distributed amplifier with low-frequency extension capabilities	2 – 26.5	8 @ 250	6.0	± 0.8	+19	chip
HMMC-5025	distributed amplifier with low-frequency extension capabilities	2 – 50	5 @ 75	8.5	± 0.5	+10	chip
HMMC-5032	compact transmitter amplifier with integrated output power detector	17.7 – 32	4.5 @ 250	8	± 1	+22	chip
HMMC-5033	high gain transmitter amplifier with integrated output power detector	17.7 – 32	5 @ 680	18	± 1	+26	chip
HMMC-5034	compact transmitter amplifier with integrated output power detector	37 – 43	4.5 @ 300	8	± 1	+23	chip
HMMC-5040	good input match to DC; can bias input stage for multiplication	20 – 40	4.5 @ 300, -0.6 V	22	± 1.5	+18	chip
HMMC-5200	general purpose HBT amplifier	DC – 20	5 @ 45	9.5	± 1	+12	chip
HMMC-5618	efficient two-stage amplifier	6 – 20	5 @ 110	14	± 0.5	+18	chip
HMMC-5620	high-gain four stage amplifier	6 – 20	5 @ 100	16	± 0.75	+14	chip

GaAs MMIC Broadband Attenuators

Part Number	Frequency Range (GHz)	Control Voltages	Min./Max. Atten (dB typ. @ GHz)	Comments	Package
HMMC-1002	DC – 50	two 0 to -4V lines	2/40 @ 26.5	general-purpose atten. (e.g., AGC loops)	chip
HMMC-1015	DC – 50	two 0 to -9V lines	2/40 @ 26.5	lower distortion general-purpose atten.	chip

GaAs MMIC SPDT Switches

Part Number	Frequency Range (GHz)	Control Voltages Complementary (V)	Insertion Loss (dB)	Isolation (dB)	P _{1dB} (dBm)	Package
HMMC-2007 (abs.)	DC – 8	+10/-10	1.1	38	> 27	chip
HMMC-2027 (abs.)	DC – 26.5	0/-10	2.5	30	> 27	chip

GaAs MMIC Mixer

Part Number	Description & Features	RF & LO Freq. Range (GHz)	IF Freq. Range (GHz)	LO Drive Level (dBm)	Bias Cond. (V @ mA)	P _{1dB} (dBm)	Conv. Loss (dB)	Package
HMMC-3040	3-PORT DBM Up/Dn converter +LO amplifier (input stage can be biased as multiplier)	20 – 43	DC – 5	2	4.5 @ 150	8 (up-conv.) 15 (dn-conv.)	9.5	chip

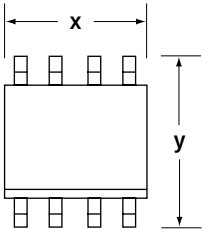
GaAs HBT Prescalers

Part Number	Description & Features	Freq. (GHz)	Input Power (dBm)	Input Bias (V @ mA) ⁽¹⁾	P _{out} (dBm)	Phase Noise (dBc/Hz)	Package
HMMC-3002	÷ 2; on-chip pre- and post-amps; differential I/O	DC –16	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 80 or 60	Dual Mode +6 or 0	-153 @ 100 KHz offset	chip
HMMC-3004	÷ 4; on-chip pre- and post-amps; differential I/O	DC –16	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 80 or 60	Dual Mode +6 or 0	-153 @ 100 KHz offset	chip
HMMC-3008	÷ 8; on-chip pre- and post-amps; differential I/O	DC –16	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 80 or 60	Dual Mode +6 or 0	-153 @ 100 KHz offset	chip
HMMC-3022	÷ 2; on-chip pre- and post-amps; differential I/O	DC –12	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 40 or 30	Dual Mode 0 or -6	-153 @ 100 KHz offset	chip
HMMC-3024	÷ 4; on-chip pre- and post-amps; differential I/O	DC –12	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 40 or 30	Dual Mode 0 or -6	-153 @ 100 KHz offset	chip
HMMC-3028	÷ 8; on-chip pre- and post-amps; differential I/O	DC –12	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 40 or 30	Dual Mode 0 or -6	-153 @ 100 KHz offset	chip
HMMC-3102	÷ 2; on-chip pre- and post-amps; differential I/O	DC –16	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 80	+6.0	-153 @ 100 KHz offset	SOIC-8
HMMC-3104	÷ 4; on-chip pre- and post-amps; differential I/O	DC –16	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 80	+6.0	-153 @ 100 KHz offset	SOIC-8
HMMC-3108	÷ 8; on-chip pre- and post-amps; differential I/O	DC –16	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 80	+6.0	-153 @ 100 KHz offset	SOIC-8
HMMC-3122	÷ 2; on-chip pre- and post-amps; differential I/O	DC –12	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 40	0	-153 @ 100 KHz offset	SOIC-8
HMMC-3124	÷ 4; on-chip pre- and post-amps; differential I/O	DC –12	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 40	0	-153 @ 100 KHz offset	SOIC-8
HMMC-3128	÷ 8; on-chip pre- and post-amps; differential I/O	DC –12	-20 to +10	Single supply Pos. OR Neg. 4.5 to 6.5 @ 40	0	-153 @ 100 KHz offset	SOIC-8

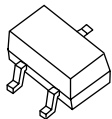
Note:

1. Higher current listed corresponds to higher output power mode; controlled by Power Select pad on chip (V_{PwrSel})

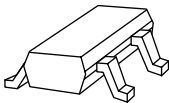
RF/mW Packaging *Quick Reference*



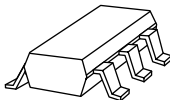
Plastic Surface Mount Packages



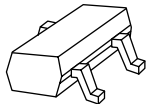
SOT323 (SC70)
3 lead
2.0 x 2.1 x 0.9 mm



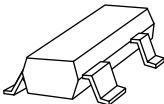
SOT343 (SC70)
4 lead
2.0 x 2.1 x 0.9 mm



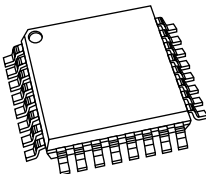
SOT363 (SC70)
6 lead
2.0 x 2.1 x 0.9 mm



SOT23
3 lead
2.9 x 2.4 x 0.9 mm



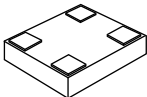
SOT143
4 lead
2.9 x 2.4 x 0.9 mm



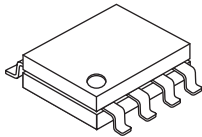
TQFP 32
32 lead
0.8 mm pitch
9.0 x 9.0 x 1.4 mm



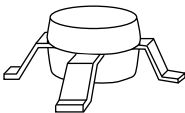
SMT 85 mil
0.85 x 0.06 mm



Mini Pak
leadless
1.44 x 1.20 mm

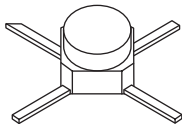


8 Lead SSOP-8
8 lead
4.8 x 3.8 x 1.35 mm

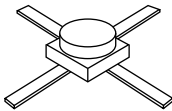


**SMT 145 mil
Package 05**
4 lead
0.145 x 0.100 mm

Ceramic Packages

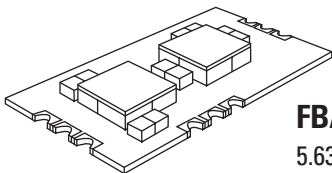


Micro-x
4.57 x 1.45 mm

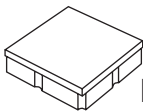


70 mil
5.28 x 1.22 mm

Filters



FBAR Duplexer
5.63 x 11.88 x 1.9 mm



FBAR Filter
3.0 x 3.0 x 1.25 mm

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