RF/Microwave
semiconductor solutions

Winter 2000/01

Microsemi

solutions

- Mobile phones
- Base stations
- Land mobile radio
- HF communications
- Military/avionics
- Medical/MRI
- Radar/phase shifters
- RF induction heating
- Sonar/ultrasonic imaging
- Gamma ray/X-ray detection

packaging

- MMSM™
- EPSM™
- Beam leads
- Powermite®
- Gigamite™
- Glass axial
- Chip diode
- Square MELF
- Plastic
- Chip scale packages

products

- InGaP amplifiers for W-CDMA/CDMA
- InGaP gain block ICs
- PIN diodes
- Schottky diodes
- Mixer Diodes
- Tuning varactors
- Step recovery diodes
- RF bipolar power transistors
- Transient voltage protection

RF/Microwave

Microsemi, loud and clear

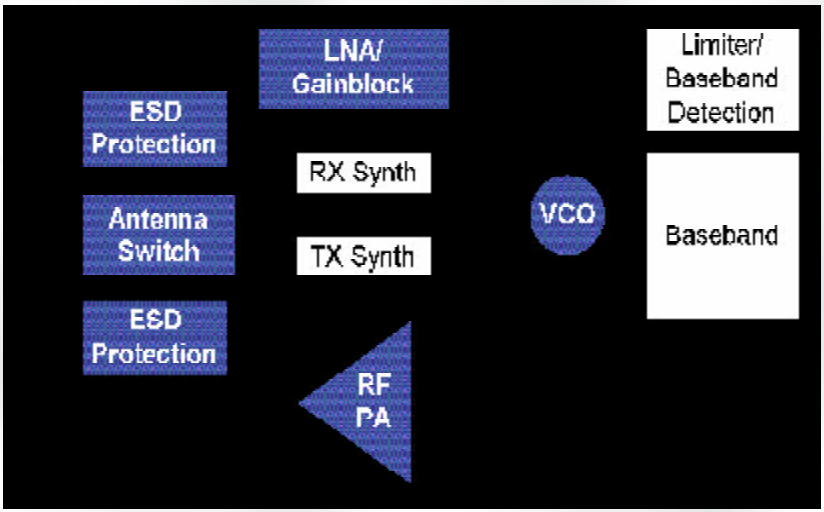
Have you heard? Microsemi is one of the most innovative sources of RF/microwave semiconductor products to be found—*anywhere*.

Microsemi's move to center stage among RF/microwave semiconductor makers comes from recent strategic acquisitions, combined with our focus on cutting-edge packaging.

Today, we're armed with unique surface mount packaging capabilities, component design talent ranging from discrete semiconductors to mixed signal, microcircuit and InGaP integrated circuits, and a rock-solid commitment to base new products on specific application needs.

Check the typical RF design below. See how far Microsemi has come in offering key components, from RF power transistors and ESD protection of RFICs to InGaP gain blocks and power amplifiers. Also review the product selection guides found in this brochure. They outline our most popular wireless solutions.

No one else can provide the thermal and power density advantages of Microsemi's Powermite, Enhanced Performance Surface Mount (EPSM), and Monolithic Microwave Surface Mount (MMSM) packaging. So no one else can create breakthrough solutions like our surface mount Gigamite products. Keep up with our latest developments and product details on the Microsemi web site.



RF integrated circuits

The MWS11-GB11 is a broadband RFIC general-purpose amplifier manufactured with an InGaP Heterojunction Bipolar Transistor (HBT) process (MOCVD). It is an easily cascadable, 50 Ohm gain block. The amplifier is self-contained with 50 Ohm input and output impedances. Gain blocks are used as RF and IF intermediate gain stages, in both the receive and transmit channels ao radio transceivers, as VCO buffer amplifiers, as power amplifier driver and pre-driver stages, and as amplifier gain stages in broadband test equipment up to 6 GHz.

Application Note AN#01 provides individual sections on these amplifier characterization issues: *Linear Transducer Gain, Gain Flatness over the Passband, Gain Block Noise Figure, Distortion Issues, and S-Parameter Characterization of the MWS11-GB11*.

The MWS11GB11 broadband, InGaP HBT gain block cascadable amplifier is available in small quantities in the SOT-89 package. In the near future, it will be available in Microsemi's exclusive new Gigamite™ package that offers superb thermal impedance performance and a package cut-off frequency in the 10 GHz range.

NEW!

MWS11-GB11
Microsemi InGaP HBT Gain Block

Features

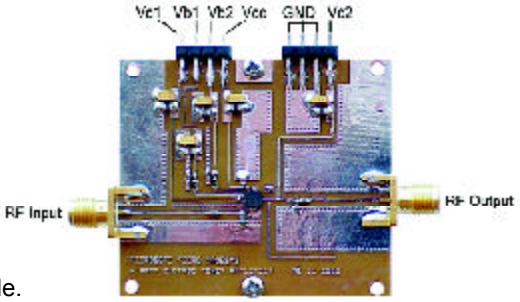
- **Low cost, broadband RFIC**
- **DC to 6 GHz**
- **Single +5V Supply**
- **Small Signal Gain = 16dB**
- **P1dB = 19dBm (5V), f = 1GHz**
- **SOT-89 Gigamite Packages**

Applications

- **Broadband Gain Blocks**
- **IF or RF Buffer Amplifiers**
- **Driver Stage for Power Amps**
- **Final Power Amp for Low-to-Medium Power Applications**
- **Broadband Test Equipment**
- **Base Stations**

InGaP HBT Power Amplifier for 3G Phones

The MWS W-CDMA is a high-efficiency linear amplifier targeting 3V mobile handheld systems. The device is manufactured in an advanced InGaP/GaAs Heterojunction Bipolar Transistor (HBT) RF integrated circuit fab process. It is designed for use as a final RF amplifier in 3V W-CDMA and CDMA2000, spread spectrum systems, and other linear applications in the 1800MHz to 2000MHz band. There are two 16-pin package versions for this power amplifier. One is a 3mm x 3mm chip scale package (CSP) with external input/output match and the other is an internally I/O matched module.

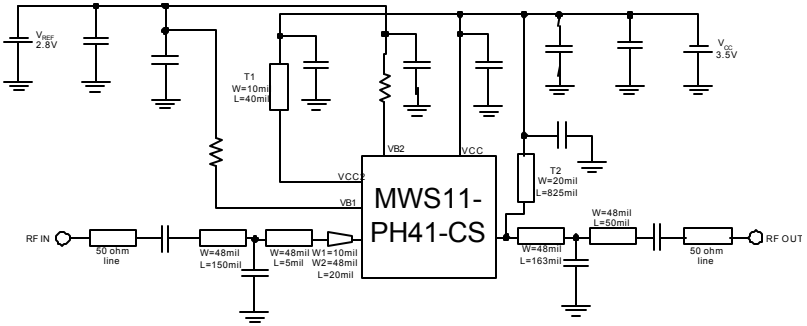


Features

- **Single 3V Supply**
- **27dBm Linear Output Power**
- **28dB Linear Gain**
- **40% Linear Efficiency**
- **70mA Idle Current**

Applications

- **3V 1920-1980 W-CDMA Handsets**
- **3V 1850-1910 CMDA2000 Handsets**
- **Spread Spectrum Systems**
- **Other Linear Wireless Applications**



PIN diodes

High Frequency PIN Diodes

		Small Signal High Speed Switching			Large Signal Low Distortion Switching or Attenuating		
Freq (GHz)	Cj,PT (pF)	70V	100V	250V	100V	300V	750V
24	0.06	GC4270	GC4120	GC4220			
18	0.1	GC4271	GC4211	GC4221	GC4410	GC4430	GC4490
12	0.2	GC4272	GC4212	GC4222			
9	0.3	GC4273	GC4213	GC4223	GC4411	GC4431	GC4491
7	0.4	GC4274	GC4214	GC4224			
5	0.5	GC4275	GC4215	GC4225	GC4412	GC4432	GC4492
4	0.75				GC4413	GC4433	GC4493
3	1.3						GC4494
2	2.5						GC4495
1	3						
		NIP Versions Also Available GC4300 SERIES			NIP Versions Also Available GC4500 SERIES (up to 300 Volts)		

Applications

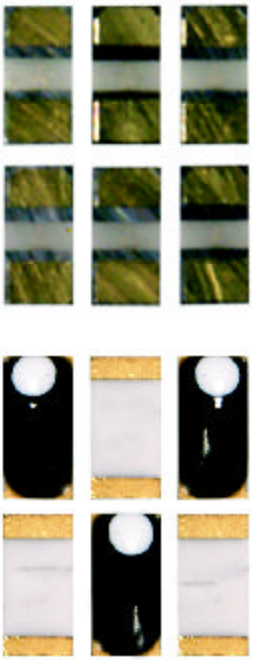
- GSM
- TAGS
- WANS
- PCS
- AMPS
- DECT
- High frequency wireless

MMSM/EPSM *the "package-less" technology*

Microsemi's Monolithic Microwave Surface Mount (MMSM) and Enhanced Performance Surface Mount (EPSM) are high frequency packaging solutions for 3rd Generation, Wireless LAN, and Aerospace Communication applications. Developed for high frequency (> 2 GHz) applications these two unique packages are the result of extensive product development to create the optimum PIN diode, varactor diode, RF Schottky, or RF transistor - without needing a bulky plastic package. The patented "package-less" technology is ideal for antenna switching and voltage control oscillator (VCO) applications where junction capacitance of less than 0.5pF is required.

MMSM Surface Mount Devices

The MPP Series of PIN diodes and MPV Series of varactor diodes utilize Microsemi's exclusive MMSM packaging technology. The technology is a package/device integration accomplished at the wafer fabrication level. Since the cathode and anode interconnections utilize precision photolithographic techniques rather than wire bonds, parasitic package inductance is tightly controlled. The package parasitics are optimized for PCS bands but devices can be used through X band.



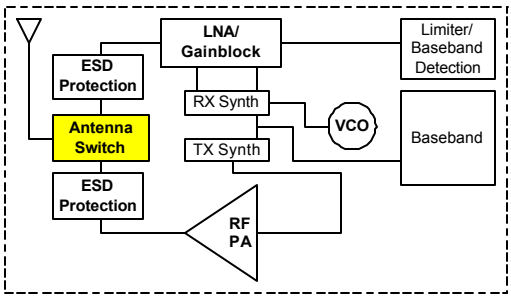
EPSM Products (Varactors/PIN Diodes)

Our EPSM packaged devices are designed for the most demanding commercial and military requirements where the inconsistency of performance inherent in plastic surface mount packages cannot be tolerated. These package styles extend the surface mount construction format to 6 GHz for high performance wireless applications including VCOs, limiters, pin switches and pin attenuators. Select varactors from three families of C/V curves, PIN diodes for switching, attenuation or limiting through 6 GHz. They are available in multiple chip configuration as well as outlines which directly replace SOT-23 and SOD-323 devices.

Power PIN Diodes

Part Number	Power (Watts)	TAU (microSec)	RS (Ohms)	VR (Volts)	fT (MHz)	Ct (pF)
UM9301	1.0	4.0	3.0	75	900	0.8
UM9301SM	1.0	4.0	3.0	75	900	0.8
UM9415	1.0	5.0	1.0	50	1500	4.0
UM7201	2.0	1.5	0.3	100	900	2.2
UM7201SM	2.0	1.5	0.3	100	900	2.2
UM7202	2.0	1.5	0.3	200	900	2.2
UM7202SM	2.0	1.5	0.3	200	900	2.2
UM7204	2.0	1.5	0.3	400	900	2.2
UM7204SM	2.0	1.5	3.0	400	900	2.2
UM6001	2.5	1.0	1.7	100	1100	0.5
UM6002	2.5	1.0	1.7	200	1100	0.5
UM6006	2.5	1.0	1.7	600	1100	0.5
UM6010	2.5	1.0	1.7	1000	1100	0.5
UM6201	2.5	0.6	0.4	100	1100	1.1
UM6202	2.5	0.6	0.4	200	1100	1.1
UM6204	2.5	0.6	0.4	400	1100	1.1
UM6601	2.5	1.0	2.5	100	1100	0.4
UM6601SM	2.5	1.0	2.5	100	1100	0.4
UM6602	2.5	1.0	2.5	200	1100	0.4
UM6602SM	2.5	1.0	2.5	200	1100	0.4
UM6606	2.5	1.0	2.5	600	1100	0.4
UM6606SM	2.5	1.0	2.5	600	1100	0.4
UM6610	2.5	1.0	2.5	1000	1100	0.4
UM6610SM	2.5	1.0	2.5	1000	1100	0.4
UM9441	2.5			100		1.2
UM9701	2.5	1.5	0.8	100	1500	1.8
UPP1001	2.5	2.0	0.5	100	1500	1.6
UPP1002	2.5	2.0	0.5	200	1500	1.6
UPP1004	2.5	2.0	0.5	400	1500	1.6
UPP9401	2.5	2.0	1.0	50	1800	1.0
UM7501	5.5	2.5	1.0	100	1100	1.0
UM7502	5.5	2.5	1.0	200	1100	1.0
UM7504	5.5	2.5	1.0	400	1100	1.0
UM7506	5.5	2.5	1.0	600	1100	1.0
UM7508	5.5	2.5	1.0	800	1100	1.0
UM7510	5.5	2.5	1.0	1000	1100	1.0
UM7512	5.5	2.5	1.0	1200	1100	1.0
UM7514	5.5	2.5	1.0	1400	1100	1.0
UM9401	5.5	1.0	1.0	50	1500	1.5
UM9401F	5.5	1.0	1.0	50	1500	1.5
UM9401SM	5.5	1.0	1.0	50	1500	1.5
UM7301	7.5	4.0	3.0	100	1800	0.7
UM7301SM	7.5	4.0	3.0	100	1800	0.7
UM7302	7.5	4.0	3.0	200	1800	0.7
UM7302SM	7.5	4.0	3.0	200	1800	0.7
UM7306	7.5	4.0	3.0	600	1800	0.7
UM7306SM	7.5	4.0	3.0	600	1800	0.7
UM7310	7.5	4.0	3.0	1000	1800	0.7
UM7310SM	7.5	4.0	3.0	1000	1800	0.7
UM9601	7.5	2.0	0.6	100	4000	1.2
UM9602	7.5	2.0	0.6	400	4000	1.2
UM9603	7.5	2.0	0.6	100	4000	1.2
UM9604	7.5	2.0	0.6	400	4000	1.2
UM9605	7.5	1.0	1.7	100	4000	1.7
UM9606	7.5	1.0	1.7	400	4000	0.5
UM9607	7.5	1.0	1.7	100	4000	0.5
UM9608	7.5	1.0	1.7	400	4000	0.5
UM4301	10.0	6.0	1.5	100	1500	2.2
UM4301SM	10.0	6.0	1.5	100	1500	2.2

Part Number	Power (Watts)	TAU (microSec)	RS (Ohms)	VR (Volts)	fT (MHz)	Ct (pF)
UM4302	10.0	6.0	1.5	200	1500	2.2
UM4302SM	10.0	6.0	1.5	200	1500	2.2
UM4306	10.0	6.0	1.5	600	1500	2.2
UM4306SM	10.0	6.0	1.5	600	1500	2.2
UM4310	10.0	6.0	1.5	1000	1500	2.2
UM4310SM	10.0	6.0	1.5	1000	1500	2.2
UM4901	10.0	5.0	0.5	100	1500	3.0
UM4901SM	10.0	5.0	0.5	100	1500	3.0
UM4902	10.0	5.0	0.5	200	1500	3.0
UM4902SM	10.0	5.0	0.5	200	1500	3.0
UM4906	10.0	5.0	0.5	600	1500	3.0
UM7001	10.0	2.5	1.0	100	900	0.9
UM7001SM	10.0	2.5	1.0	100	900	0.9
UM7002	10.0	2.5	1.0	200	900	0.9
UM7002SM	10.0	2.5	1.0	200	900	0.9
UM7006	10.0	2.5	1.0	600	900	0.9
UM7006SM	10.0	2.5	1.0	600	900	0.9
UM7010	10.0	2.5	1.0	1000	900	0.9
UM7010SM	10.0	2.5	1.0	1000	900	0.9
UM7101	10.0	2.0	0.6	100	900	1.2
UM7101SM	10.0	2.0	0.6	100	900	1.2
UM7102	10.0	2.0	0.6	200	900	1.2
UM7102SM	10.0	2.0	0.6	200	900	1.2
UM7104	10.0	2.0	0.6	400	900	1.2
UM7104SM	10.0	2.0	0.6	400	900	1.2
UM7108	10.0	2.0	0.6	800	900	1.2
UM7108SM	10.0	2.0	0.6	800	900	1.2
UM9402	10.0	1.0	1.0	50	1500	1.5
UM4001	12.0	5.0	0.5	100	1500	3.0
UM4001SM	12.0	5.0	0.5	100	1500	3.0
UM4002	12.0	5.0	0.5	200	1500	3.0
UM4002SM	12.0	5.0	0.5	200	1500	3.0
UM4006	12.0	5.0	0.5	600	1500	3.0
UM4006SM	12.0	5.0	0.5	600	1500	3.0
UM4010	12.0	5.0	0.5	1000	1500	3.0
UM4010SM	12.0	5.0	0.5	1000	1500	3.0
UM4906SM	12.0	5.0	0.5	600	1500	3.0
HUM2010	13.0	10.0	0.2	1000	250	4.0
HUM2015	13.0	10.0	0.2	1500	250	4.0
HUM2020	13.0	10.0	0.2	2000	250	4.0
UM2101	25.0	60.0	2.0	100	30	2.5
UM2102	25.0	60.0	2.0	200	30	2.5
UM2104	25.0	60.0	2.0	400	30	2.5
UM2106	25.0	60.0	2.0	600	30	2.5
UM2108	25.0	60.0	2.0	800	30	2.5
UM2110	25.0	60.0	2.0	1000	30	2.5
UM2301	1000.0	80.0	0.4	100	20	20.0
UM2301S	1000.0	80.0	0.4	100	20	20.0
UM2302	1000.0	80.0	0.4	200	20	20.0
UM2302S	1000.0	80.0	0.4	200	20	20.0
UM2304	1000.0	80.0	0.4	400	20	20.0
UM2304S	1000.0	80.0	0.4	400	20	20.0
UM2306	1000.0	80.0	0.4	600	20	20.0
UM2306S	1000.0	80.0	0.4	600	20	20.0
UM2308	1000.0	80.0	0.4	800	20	20.0
UM2308S	1000.0	80.0	0.4	800	20	20.0
UM2310	1000.0	80.0	0.4	1000	20	20.0
UM2310S	1000.0	80.0	0.4	1000	20	20.0



tuning varactors

Frequency Band	Super Hyper Vb=12V P/N Series	High "S" Linear Vb=22V P/N Series	Low "S" Linear Vb=22 V P/N Series	Hyper Vb=22 V P/N Series	Abrupt Vb=30V Chip Ceramic Glass*	Abrupt Vb=30V EPSM	Abrupt Vb=30V SOT-23	Abrupt Vb=20V Glass
Microwave	KV199x	GC15006	GC15001	KV211x	GC1500A	GC1300	GC1202	
to 18 GHz	KV198x	GC15007	GC15002	KV212x	GC1500B	GC1301	GC1203	
	KV197x	GC15008	GC15003	KV213x	GC1500	GC1302	GC1204	
	KV196x	GC15009	GC15004	KV214x	GC1501	GC1303	GC1205	
	KV194x	GC15010	GC15005	KV215x	GC1502	GC1304	GC1206	
	KV193x			KV216x	GC1503	GC1305	GC1207	N/A
					GC1504	GC1306		
					GC1505	GC1307		
					GC1506	GC1308		
					GC1507	GC1309		
						GC1310		
UHF	KV192x	GC15011	GC15014	KV2101	GC1508		GC1208	KV620
to 1.0 GHz	KV195x	GC15012	GC15015	KV3201	GC1509		GC1209	KV621
	KV191x	GC15013	GC15016	KV3901	GC1510		GC1210	KV622
				KV2801	GC1511	N/A	GC1211	KV623
					GC1512		GC1212	KV624
					GC1513		GC1213	KV625
							GC1214	KV626
VHF	KV1401			KV2001	1N5441		GC1215	KV627
to 250 MHz	KV1501	N/A	N/A	KV2201	thru	N/A	GC1216	Thru
				KV2301	1N5476		GC1217	KV650
HF	KV1601			KV2401				
1 – 50 MHz	KV1701	N/A	N/A	KV2501	N/A	N/A	N/A	N/A
	KV1801			KV2601				
				KV2701				

Extensive application note assistance can be found in the Microsemi web site's RF/ Microwave section on variable capacitance diodes (tuning varactors). Fundamentals are covered in a chapter on *Frequency Linear Tuning Varactors* which provides an introduction to hyperabrupt tuning diodes. Additional chapters cover *Low Distortion FM Generation & Detection Using Hyperabrupt Tuning Diodes*,and designing *HF-VHF-UHF Voltage Controlled Oscillators (VCOs) Using Hyperabrupt Tuning Diodes*. For direct access link: http://www.microsemi.com/datasheets/5000040.pdf.

Schottky mixer diodes

Frequency Range	Part Number	Barrier	Vb min (V)	Cj max (pF)	VF max (mV)	Rd max (Ohms)	NFssp Typ (dB)	Zif typ (Ohms)
Ku-Ka	GC9901	ULTRA-LOW	2	0.09	310	18	6.5	140
X	GC9902			0.15	280	14	6	
C	GC9903			0.3	270	12	5.5	
S	GC9904			0.5	250	10	5.5	
Ku-Ka	GC9911	LOW	2	0.09	360	18	6.5	170
X	GC9912			0.15	350	14	6	
C	GC9913			0.3	340	12	5.5	
S	GC9914			0.5	330	10	5.5	
Ku-Ka	GC9921	LOW-MED	2	0.15	440	18	6.5	200
X	GC9922			0.15	430	14	6	
C	GC9923			0.3	410	12	5.5	
S	GC9924			0.5	390	10	5.5	
Ku-Ka	GC9931	MEDIUM	3	0.3	540	18	6.75	250
X	GC9932			0.15	530	14	6.25	
C	GC9933			0.3	520	12	5.75	
S	GC9934			0.5	500	10	5.5	
Ku-Ka	GC9941	HIGH	4	0.5	650	20	7	300
X	GC9942			0.15	630	16	6.25	
C	GC9943			0.3	620	12	5.75	
S	GC9944			0.5	600	10	5.75	

For more information regarding Microsemi's Schottky diodes in microwave applications, refer to our web site link: http://www.microsemi.com/datasheets/5000003.pdf. You will find details on: *High Power and General Purpose Schottky Diodes*, *Monolithic Schottky Devices for Mixers to 26.5 GHz, Ultra High Drive Monolithic Schottky Devices, Detector Applications Notes,* and *Detector Diode Selection Guide.*

RF transistors

HF Transistors

PART NO.	FREQ. (MHz)	Pout Min (W PEP)	Pin (W)	GAIN Min (dB)	BIAS Vce (V)	BIAS Icq (mA)	?jc Max ??C/W)	IMD (dBC)	PKG STYLE
MS1226	30	30	0.48	18	28	25	2.2	-28	M113
MS1001	30	75	3.8	13	12.5	100	0.65	-32	M174
MS1007	30	150	6	14	50	100	2	-30	M174
MS1004	30	250	10	13.5	50	150	0.4	-30	M177

High Band FM/UHF TV Bands

PART NO.	FREQ. (MHz)	Pout Min (W)	Pin (W)	GAIN Min (dB)	?c Min (%)	Vcc (V)	?jc Max ??C/W)	PKG STYLE
MRF4427	175	1	0.15	18	60	12.5	80	M254
MRF553	175	1.5	0.105	11.5	50	12.5	25	M234
SD1012	175	4	0.25	12	50	12.5	-	M135
SD1143	175	10	1	10	-	12.5	8.75	M135
SD1272	175	25	3	9.2	-	12.5	3.5	M135
SD1224	175	40	7	7.6	60	28	2.9	M135
MS1003	175	100	25	6	-	12.5	0.65	M111

LNA General Purpose

PART NO.	f_T (MHz)	Gu MAX (dB)	G_{NF} (dB)	Noise Figure f (MHz)	Noise Figure Vce (V)	Noise Figure Ic (mA)	NF MIN (dB)	Cob Max (pF)	PACKAGE
BFR96	500	14.5	-	500	10	10	2	3.2	M236
MRF5943	1300	15	-	-	-	-	-	3	M254
BFY90	1300	19	-	500	5	2	2.5	2	M244
MRF586	3000	12.5	-	-	-	-	-	3	M246
MRF517	4000	9	-	300	15	50	7.5	4.5	M246
MRF581	5000	15	14	500	10	50	2	3	M238
MRF581A	5000	15	14	500	10	50	2	2	M238
BFR91	5000	16.5	11	500	5	2	1.9	1	M236
MFR5812	5000	17.8	15.5	500	10	50	2.5	2	M254
BFR90	5000	18	15	500	10	2	2.4	1	M236
MRF951	8000	-	14	1000	6	5	1.3	0.45	M238

UHF TV Bands

PART NO.	FREQ. (MHz)	Pout Min (W)	Pin (W)	GAIN Min (dB)	BIAS Vce (V)	BIAS Icq (mA)	IMD (dBC)	?jc Max ??C/W)	COB Max (pF)	PACKAGE
MS1512	860	1	0.1	10	20	440	-58	9	7	M122
MS1581	860	4	0.8	7	25	850	-60	5.5	20	M122
MS1579	860	14	1.2	8.5	25	2x850	-45	2.5	17.5	M156
MS1582	860	25	4	8	25	2x1600	-45	1.3	80	M173
MS1584	860	50	10.5	6.8	28	2x250	-30	1	70	M173
MS1576	860	150	21	8.5	28	2x200	-30	0.6	70	M208

RF transient voltage suppression

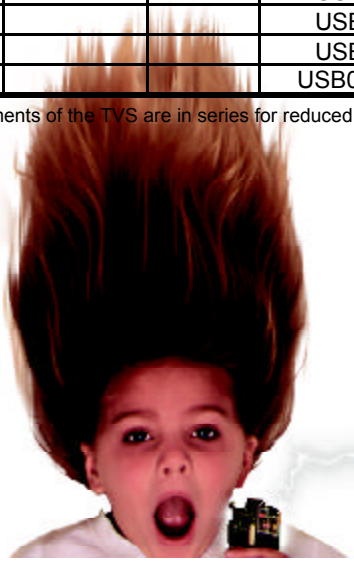
LoCAP™ Silicon TVS Devices

Device series	Surge Power	Waveform	Capacitance	Package	Voltage Range
LC6.5	1.5KW	10/1000µs	50pf	DO-13	6.6V - 170V
LCE6.5	1.5KW		50pf	Axial lead	6.5V - 170V
SAC5	500W		25pf	Axial lead	5.0V - 50V
SMCJLCE5.0	1.5KW		50pf	SMT/DO-214AB	5.0V - 50V
SMBJSAC5.0	500W		25pf	SMT/DO-214AA	5.0V - 50V
SMP6LC6.5	600W		30pf	SO-16	6.5V - 170V
SM8LC03	300W	8/20µs	25pf	SO-8	3.0V - 24V
SM16LC03	300W		25pf	SO-16	3.0V - 24V
USB0403C	300W		5pf	SO-4	3.0V - 24V
USB0803C	300W		5pf	SO-8	3.0V - 24V

TVS Devices for Common Applications

Upper Limits	Primary Threats			Recommended TVS	Surge
bits	ESD	Load Switch	Lightning	Family	Power
250kb	*	*	*	LC6.5	1.5kW
250kb	*	*	*	LCE6.5	1.5kW
250kb	*	*	*	SMJLC5.0	1.5kW
1.5Mb	*	*	*	SAC5.0	600W
1.5Mb	*	*	*	SMBLSAC5.0	600W
1.5Mb	*	*	*	SMP6LC6.5	600W
5Mb	*			SM8LC03	300W
5Mb	*			SM16LC03C	300W
12.5Mb	*			USB0403C	300W
12.5Mb	*			USB0803C	300W
125Mb	*			USB0403C	300W
125Mb	*			USB0403C	300W
1Gb	*			USB0803C (1)	300W

(1) only when both elements of the TVS are in series for reduced capacitance.



MRF transistors

Microsemi's MRF transistor line includes a broad selection of bipolar semiconductor devices originally developed by Motorola and SGS-Thomson, acquired by Microsemi for continued customer supply and on-going enhancements.

Microsemi's die geometries can produce commercial and military products covering applications ranging from 2 MHz to 4 GHz. From this portfolio, and Microsemi's packaging capabilities, we are able to offer devices that meet or exceed a wide range of customer specifications.

Among applications for our MRF transistors are VHF, UHF and general purpose RF amplifiers, pre-driver and output stages, oscillator and frequency-multipliers; low noise broadband amplifiers; high frequency and medium and high resolution color video display monitors; and other devices requiring high breakdown characteristics.

MRF Transistors

Part No	Description	www.microsemi.com/datasheets
MRF1001A	Silicon Bipolar RF NPN transistor, designed for VHF and UHF equipment. Applications include amplifier; pre-driver, driver, and output stages. Also suitable for oscillator and frequency-multiplier functions.	MSC1311.PDF
MRF3866	Silicon Bipolar RF NPN transistor, designed for general-purpose RF amplifier applications, such as; pre-drivers, Oscillators, etc. Maximum Available Gain = 17 dB @ 300 MHz	MSC1312.PDF
MRF3866R1	Silicon Bipolar RF NPN transistor, designed for general-purpose RF amplifier applications, such as; pre-drivers, Oscillators, etc. Maximum Available Gain = 17 dB @ 300 MHz	MSC1312.PDF
MRF3866R2	Silicon Bipolar RF NPN transistor, designed for general-purpose RF amplifier applications, such as; pre-drivers, Oscillators, etc. Maximum Available Gain = 17 dB @ 300 MHz	MSC1312.PDF
MRF4427	Silicon Bipolar RF NPN transistor, designed for general-purpose RF amplifier applications, such as; pre-drivers, Oscillators, etc. Maximum Available Gain – 20dB(typ) @ 200MHz	MSC1313.PDF
MRF4427R1	Silicon Bipolar RF NPN transistor, designed for general-purpose RF amplifier applications, such as; pre-drivers, Oscillators, etc. Maximum Available Gain – 20dB(typ) @ 200MHz	MSC1313.PDF
MRF4427R2	Silicon Bipolar RF NPN transistor, designed for general-purpose RF amplifier applications, such as; pre-drivers, Oscillators, etc. Maximum Available Gain – 20dB(typ) @ 200MHz	MSC1313.PDF
MRF517	Silicon Bipolar RF NPN transistor, designed for VHF and UHF equipment. Applications include low noise broadband amplifier; pre-driver, driver, and output stages. 3 GHz Current-Gain Bandwidth Product (min) @ 60mA, Broadband Noise Figure = 7.5 dB @ 50mA, 30 MHz	MSC1302.PDF
MRF544	Silicon Bipolar RF NPN transistor, designed primarily for use in high frequency and medium and high resolution color video display monitors as well as other applications requiring high breakdown characteristics. Maximum Unilateral Gain = 13.5 dB (typ) @ 200MHz	MSC1314.PDF
MRF545	Silicon Bipolar RF NPN transistor, designed primarily for use in high frequency and medium and high resolution color video display monitors as well as other applications requiring high breakdown characteristics. Maximum Unilateral Gain = 14 dB (typ) @ 200MHz	MSC1315.PDF
MRF553	Silicon Bipolar RF NPN Transistor designed primarily for wideband large signal stages in the VHF frequency range.	MSC1316.PDF
MRF559	Silicon Bipolar RF NPN Transistor, designed primarily for wideband large signal stages in the UHF frequency range.	MSC1317.PDF
MRF581	Silicon Bipolar RF NPN Transistor, designed for high current, low power, low noise, amplifiers up to 1.0 GHz.	MSC1318.PDF
MRF5812	Silicon Bipolar RF NPN Transistor designed for high current, low power, low noise, amplifiers up to 1.0 GHz.	MSC1319.PDF
MRF581A	Silicon Bipolar RF NPN Transistor, designed for high current, low power, low noise, amplifiers up to 1.0 GHz.	MSC1318.PDF
MRF586	Silicon Bipolar RF NPN transistor, designed for VHF and UHF equipment. Applications include amplifier; pre-driver, driver, and output stages. Also suitable for oscillator and frequency-multiplier functions. Ftau = 3.0 Ghz (typ) @ 300MHz, 14v, 90mA,	MSC1320.PDF
MRF5943	Silicon Bipolar RF NPN transistor, designed for general-purpose RF amplifier applications, such as pre-drivers, drivers, Oscillators, etc. Maximum Available Gain = 17dB @ 300MHz	MSC1321.PDF

mobile phone & radio applications

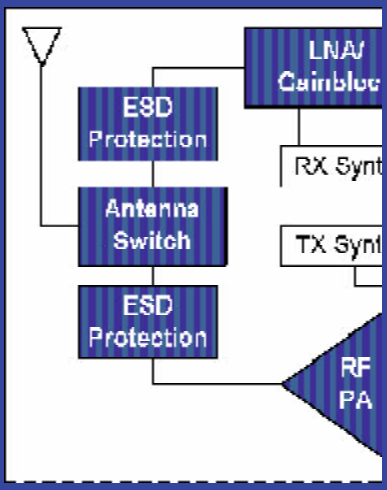
Innovative packaging capabilities that save precious board space make Microsemi a significant supplier of RF/microwave semiconductors for mobile phone applications.

By packaging a PIN diode antenna switch using Microsemi's patented flip-chip MicroMiniature Surface Mount (MMSM) technology we can reduce this device to a mere 0.020 x 0.040 x 0.015 inches (0.508 x 1.016 x 0.381 mm). This high performance series provides low capacitance performance up to 12GHz.

From Microsemi's Micro WaveSys Design Center come high speed compound semiconductor RFICs for mobile communications applications. Designed to be highly efficient with speeds from 800MHz to 20GHz, these ASIC designs can be fabricated within the Microsemi Network, or by one of our external merchant market wafer fabs.

EDS Protection: Microsemi's TVS protection devices and TVSarrays® lead the industry by providing ESD protection with the lowest capacitance specifications to be found anywhere, plus exclusive Microsemi advanced packages.

LNA/Gainblock: Microsemi offers LNA/ Gainblock solutions in both silicon and GaAs technologies to meet the size and performance specifications required for a wide range of mobile phone designs. Our new general purpose InGaP/GaAs HBT wide band gain block amplifiers are of 3V/5V, DC-3GHz and DC-6GHz (50 Ohm cascadable) with 12-17dB gain and P1dB up to 19dBm (5V) in advanced Microsemi packages.



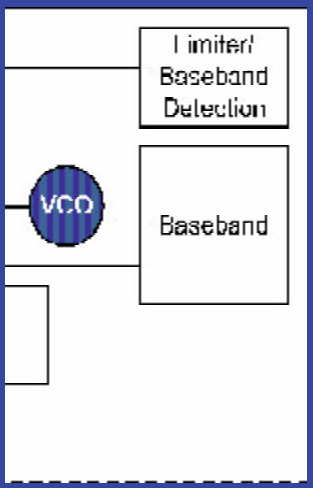
VCO: Microsemi's Microwave Products Division has more than three decades experience in providing varactor devices for VCO applications. Our selection of varactors and PIN diodes covers a range from 2-10 GHz.

FM Land Mobile Radio RF Transistors

PART NO.	FREQ. (MHz)	Pout Min (W)	Pin (W)	GAIN Min (dB)	Vcc (V)	?jc Max ?(C/W)	PKG STYLE
MRF555	470	1.5		11	12.5	25	M234
MS1402	470	2	0.2	10	12.5	35	M122
MS1404	470	5	0.7	8.5	12.5	11.6	M122
MS1426	470	10	2	7	12.5	3	M122
SD1429-03	470	15	2.5	7.8	12.5	4.6	M111
SD1422	470	25	6	6.2	12.5	2.5	M111
MS1480	470	45	14	5	12.5	1	M111

LNA General Purpose RF Transistors

PART NO.	f_T (MHz)	Gu MAX (dB)	G_{NF} (dB)	Noise Figure f (MHz)	Vce (V)	Ic (mA)	NF MIN (dB)	Cob Max (pF)	PACKAGE
BFR96	500	14.5	-	500	10	10	2	3.2	M236
MRF5943	1300	15	-	-	-	-	-	3	M254
BFY90	1300	19	-	500	5	2	2.5	2	M244
MRF586	3000	12.5	-	-	-	-	-	3	M246
MRF517	4000	9	-	300	15	50	7.5	4.5	M246
MRF581	5000	15	14	500	10	50	2	3	M238
MRF581A	5000	15	14	500	10	50	2	2	M238
BFR91	5000	16.5	11	500	5	2	1.9	1	M236
MFR5812	5000	17.8	15.5	500	10	50	2.5	2	M254
BFR90	5000	18	15	500	10	2	2.4	1	M236
MRF951	8000	-	14	1000	6	5	1.3	0.45	M238



RF Power Amplifier: Microsemi's Micro WaveSys operation has designed a new line of low noise InGaP/GaAs HBT wide band amplifiers of 3V/5V DC-3GHz and DC-6GHz (NF<2dB) with 20dB gain and Pout up to 0dBm in advanced Microsemi packages. In development are PCS/ WCDMA and CDMA/GSM power amplifiers with a choice of unmatched or matched module options.

Antenna Switch: Microsemi's PIN diodes for antenna switch applications feature exclusive PowerMite®, EPSM and MMSM surface mount packaging options, combined with an unmatched level of experience in diode design, manufacture and application.

base station applications

Microsemi provides a broad selection of power bipolar RF transistors, varactor tuning diodes, PIN diodes and RF integrated circuits for use in base station applications.

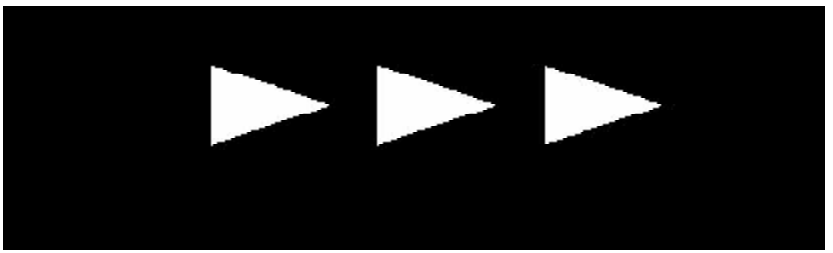
- Our power transistor lineup covers cellular GSM base station bands from 860 MHz to 960 MHz, all designed specifically for Class AB common emitter operation, for optimum linearity performance. Broadband performance is achieved by using internal input and output matching. All Microsemi RF transistors use gold metalization for maximum reliability.

- Microsemi's new line of RF integrated circuits includes general purpose InGap HBT Gain Block amplifiers in surface mount SOT-89 and Gigamite packages.

- Microsemi's tuning varactors cover frequency bands from 1MHz to 18,000 MHz, including the UHF range used in base station applications. Designers can select from Super Hyper, High "S" Linear, Low "S" Linear, Hyper and Abrupt Junction devices.

- Microsemi long has been a leading supplier of PIN diodes used in control circuits of wireless communications systems, ranging from 2 MHz to 2.4 GHz. Typical applications are in antenna transmit/receive and duplexing switching.

GSM Base Station Recomended Line-up



FM Base Station 806MHz - 960MHz RF Transistors

Part Number	Frequency (MHz)	Pout (W) min	Pin (W)	gain (dB)min	nc (%) min	Vcc (V)	Ojc (C/W) max	Pkg Style
MS1455	836	45	15	4.7	-	12.5	1.2	M142
MRF559	870	0.5		8	70	7.5		M238
MRF8372	870	0.75		8	55	12.5		M254
MRF557	870	1.5		8	55	12.5		M234
SD1400-02	900	14	1.5	9.7	55	24	3	M118
SD1496	900	60	10.6	7.5	50	24	0.9	M142
SD1495-03	960	30	6	7	50	24	1.5	M142

Configuration: Common Base, Operated Class C

Cellular Base Station 860MHz - 960MHz RF Transistors

Part Number	Frequency (MHz)	Pout (W) min	Pin (W)	gain (dB)min	bias Vce (V)	bias Icq (mA)	Ojc (C/W) max	COB (pF) max	Pkg Style
MS1578	860-900	150	24	8	26	2x150	0.6	75	M208
SD1420-01	860-900	0.9	0.1	9.5	24	125	20	5	M123
MS1530	860-900	60	10.5	7.5	26	200	1.2	-	M173

Configuration: Common Emitter, Operated Class AB

PIN Diodes

Part Number	VB	Ct @ VR max	Rs @ IF max	TL typ	Application
LSP1000	35 min	0.28 @ 5V	2.5 Ohms @ 5mA	80 nS	Switch
LSP1002	100 min	0.32 @ 50V	4.0 Ohms @ 100mA	1500 nS	Attenuator
LSP1004	35 min	0.75 @ 20V	0.6 Ohms @ 10mA	150 nS	Switch
LSP1011	200 min	0.35 @ 50V	2.0 Ohms @ 100mA	2000 nS	Attenuator
LSP1012	20 min	0.35 @ 10V	1.8 Ohms @ 10mA	5 nS	Limiter

Super Hyperabrupt Varactors, High Sensitivity VCOs

Part Number	CT1 (min)	CT2.5	CT4 (max)	CT8 (max)	Q (4V/50MHz) min
KV1913A	36 pF	18 - 27 pF	12.0 pF	6.20 pF	400
KV1953A	26 pF	13 - 20 pF	9.0 pF	4.70 pF	500
KV1923A	17 pF	8.5 - 13 pF	6.0 pF	3.20 pF	600
KV1933A	13 pF	6.5 - 10 pF	4.5 pF	2.70 pF	750
KV1943A	9 pF	4.5 - 6.5 pF	3.0 pF	1.70 pF	900
KV1963A	4 pF	2.0 - 3.0 pF	1.5 pF	1.00 pF	1200
KV1973A	1.8 pF	1.1 - 1.5 pF	0.8 pF	0.55 pF	1400
KV1983A	1.2 pF	0.8 - 1.1 pF	0.6 pF	0.45 pF	1600
KV1993A	0.6 pF	0.5 - 0.8 pF	0.4 pF	0.35 pF	1800

Microwave Hyperabrupt Varactors, Wide Bandwidth VCOs

Part Number	CT0 typical	CT4	CT20 max	Q (4V/50MHz) min
KV2163	26 pF	8.75 - 10.80 pF	2.50 pF	400
KV2153	13.5 pF	4.45 - 5.50 pF	1.30 pF	600
KV2143	7 pF	2.65 - 3.30 pF	0.90 pF	700
KV2133	5 pF	1.75 - 2.20 pF	0.70 pF	850
KV2123	3 pF	1.30 - 1.65 pF	0.55 pF	1000
KV2113	2 pF	0.85 - 1.10 pF	0.45 pF	1200

Microwave Abrupt Varactors, Moderate Bandwidth Low Noise VCOs

Part Number	CT0/CT4 (min)	CT4 +/- 10%	CT4/CT30 (min)	Q (4V/50MHz) min
GC1300	1.5	0.8 pF	1.45	3900
GC1301	1.6	1.0 pF	1.55	3800
GC1302	1.7	1.2 pF	1.60	3700
GC1303	1.8	1.5 pF	1.65	3600
GC1304	1.9	1.8 pF	1.70	3500
GC1305	2.0	2.2 pF	1.75	3400
GC1306	2.0	2.7 pF	1.80	3300
GC1307	2.1	3.3 pF	1.85	3100
GC1308	2.1	3.9 pF	1.85	2700
GC1309	2.1	4.7 pF	1.85	2600
GC1310	2.1	5.6 pF	1.85	2500

RF products for avionics

Microsemi's experience in providing discrete semiconductor solutions for military/aerospace applications extends to its founding days, four decades ago. Today, its RF/microwave devices for military avionics includes an extensive portfolio of PIN diodes, Schottky diodes, and varactors.

In addition to PIN diode antenna and duplexing switch applications, Microsemi offers PIN diode devices for RF attenuator circuits, RF modulators, and RF phase shifters. Detailed descriptions of all these circuit designs can be found in Microsemi's PIN Diode Handbook, version 2.

PIN Nuclear Radiation Detectors

Features

- **High Reliability**
- **Fast Rise Time**
- **Wide Dynamic Range**
- **Low Operating Voltage**
- **High Photocurrent Sensitivity**
- **Hardness to Neutron Bombardment**

Microsemi's UM9441 Series provides silicon PIN devices for effective detection of nuclear and electromagnetic radiation, including gamma radiation, electrons and x-rays. These devices can be used across a temperature range of –55° C to +175°C.

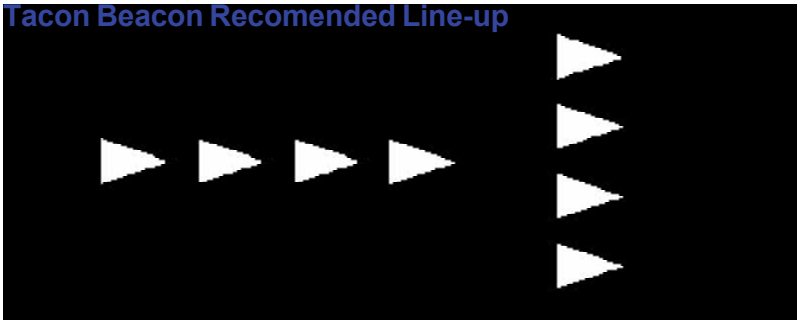
Absolute Maximum Ratings
Operating Temperature: -55°C to +175°C
Storage Temperature: -55°C to +200°C
Photocurrent: 3Adc, $3A^2s$ pulsed
Reverse Voltage: 100V

RF Transistors for Avionics Applications

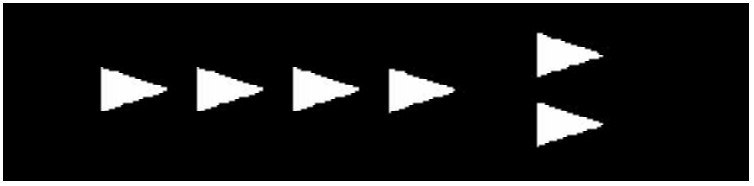
PART NO.	FREQ. (MHz)	Pout Min (W)	Pin (W)	GAIN Min (dB)	?c Min (%)	Vcc (V)	?jc Max ??C/W)	PULSE WIDTH (? SEC)	DUTY CYCLE (%)	PKG STYLE
MS2229	1090	55	7.4	8.7	45	50	1.1	32	2	M214
MS2228	1090	75	10	8.7	45	50	0.86	32	2	M214
MS2207	1090	400	63	8	45	50	0.17	32	2	M216
MS2208	1090	500	70	8.5	40	50	0.11	32	2	M198
MS2475	1090	720	150	6.8	35	50	0.09	10	1	M216
MS2203	1025-1150	0.6	0.05	10.8	---	18	35	CW	CW	M220
SD1526-01	1025-1150	5	0.55	9.5	-	28	8	10	1	M115
MSC1015M	1025-1150	15	1.5	10	35	50	2	10	1	M220
MS2553	1025-1150	35	3	10.6	43	50	1	10	1	M220
SD1536-03	1025-1150	90	13	8.4	35	50	0.6	10	1	M220
MSC1400M	1025-1150	400	90	6.5	40	50	0.12	10	1	M216
MS2211	960-1215	6	0.7	9.3	45	28	7	BURST		M222
MS2213	960-1215	30	5	7.8	40	35	2.2	BURST		M214
MS2209	960-1215	90	13	8.4	38	50	0.8	10	10	M218
MS2215	960-1215	150	26.7	7.5	45	35	0.57	BURST		M216
MS2267	960-1215	250	40	8	38	50	0.28	20	5	M214
MS2272	960-1215	350	60	7.6	38	50	0.16	10	10	M216

BURST: 254 Pulse Burst; 6.4 uS on, 6.6 uS off
Overall Duty Cycle = 20.8%

Tacon Beacon Recomended Line-up



IFF Transponder Recomended Line-up



MRI applications

Manufacturers of magnetic resonance imaging systems (MRI) use a substantial number of very sophisticated microwave components in the RF and signal processing parts of their systems.

Background

For medical diagnosis, the basic MRI system consists of a large, powerful magnet (0.1 to 10 Telsa) surrounding a chamber large enough for a patient to lie down inside it *(Figure 1).* It also employs a high power, frequency-tunable, RF source that can be switched on and off rapidly, producing a large RF field perpendicular to the magnetic field. This RF field is focused by the body coil. The RF source and both coils must be tunable in both frequency and impedance to "match the impedance" of the patient's body.

State-of-the-art systems use four or more special-purpose coils with separate receivers to optimize the signal-to-noise ratio (SNR) from a given region of the body. This method is often referred to as a "phased array system," although the signals are not added such that the signal phase information is included.

Normally, the RF signal is in the range of 10-100 MHz. During a typical set of clinical image measurements, the entire frequency spectrum of interest is of the order 10 KHz, an extremely narrow band, considering that the center frequency is about 100 MHz. This allows the use of single-frequency matching techniques for coils because their inherent bandwidth always exceeds the image bandwidth. This is an extremely important consideration when specifying PIN diodes for coil switching elements.

Image quality depends on the signal-to-noise ration of the acquired signal from the patient. SNR is of the utmost importance in obtaining clear MRI images of the interior of the human body.

PIN Switching Diodes in RF-Coil Designs

Figure 2 illustrates a basic circular loop with a single capacitive gap. The gap is shunted by a series combination of an RF coil (Ls) and a PIN diode. Individual reactance of Ls and C_G are about 50 Ohms at the operating frequency. For simplicity, the bias circuitry and the 50 Ohm RF output line across the PIN diode are not shown. The value of Ls is chosen such that the inductive reactance of the coil (Ls) and the capacitive reactance of the gap are in parallel (phase) resonance when the PIN diode is forward biased. This parallel resonance causes a large impedance (or zero conductance) to appear across the gap, causing the RF loop current to decrease to zero d(open circuit or OFF state). Multiple PIN diode switch configurations are used in MRI system designs.

Figure 2 *Simple Circular Loop With One Switched Gap*

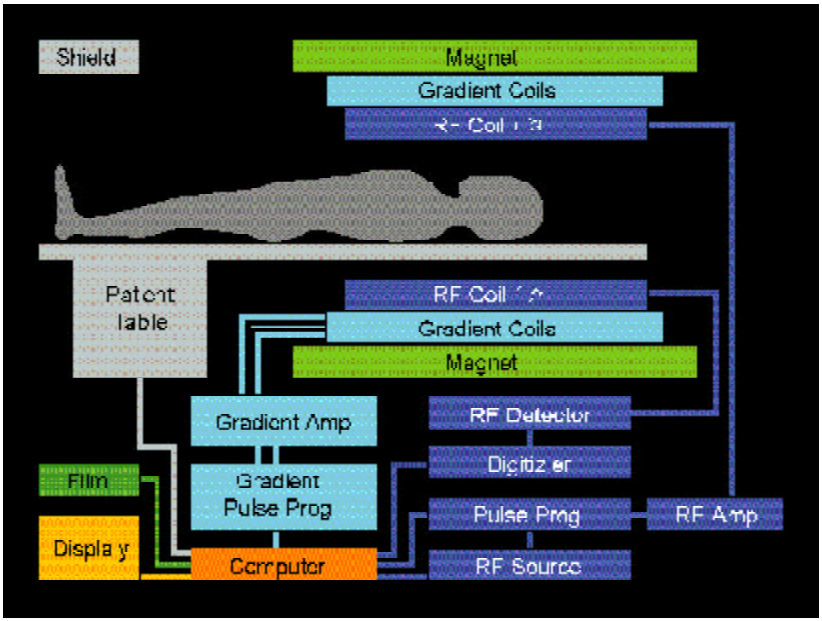


Figure 1 *Typical MRI System*

A practical MRI coil would have two or more gaps. A second gap is needed to apply an REF synchronization pulse of frequency distribution {[sin x} / x} to time the initial test pulse and the image response pulse. The capacitive gaps permit the flow of RF current through the MRI loop. The PIN diode bias network inhibits the flow of RF current through the PIN diode, although the diode must withstand the RF line voltage when it is back biased.

Key Features of PIN Switching Diodes for MRI Designs

- **No Magnetic Materials:** In the die, the die attach metalization system, or the RF package assembly.
- **Signal-To-Noise Ratio:** When MRI coil switches are OFF (reverse biased), the receivers are listening to the image return pulse. The receivers' SNR is degraded by the OFF impedance of the RF switch. This effect is specified by the reverse bias leakage current (I_R) at the PIN diode's reverse bias resistance (Rp) of the reverse biased PIN diode. Gradual increase of SNR due to the increase of reverse bias leakage current results from poor passivation of the PIN diode's I-region. Microsemi PIN diodes are passivated with a unique proprietary glass passivation process to avoid this problem.
- **Impedance matching:** Common RF frequencies used in commercial MRI system designs are 21 MHz and 64 MHz. Image search and tune bandwidths are 4, 8, and 16 KHz. Absolute values of PIN diode parasitic impedances is less important than their potential variation from lot to lot. For such narrow band applications, parasitic impedances can be compensated for in the initial switch design.

application notes

Microsemi's web site provides a wealth of information relating to RF/Microwave applications in documents we call *MicroNotes*™ and articles published in our technical magazine, *MicroCurrents.* Among them you can find coverage on the following subjects:

MicroNotes

MicroNote # 122: *Transient Voltage Protection across High Data Rate and RF Lines.* Provides basic information on application of Microsemi's LoCap TVS devices to protect high data rate and RF lines.

MicroNote #701: *PIN Diode Fundamentals.* Derived from Microsemi's definitive PIN Diode handbook, this article provides basic terms and formulas used in the selection and application of PIN diodes.

MicroNote #704: *Potential Use of RF PIN Diodes in Hand Held Transceivers.* Provides a thought-provoking discussion of how RF PIN diodes can become a viable alternative in hand held transceiver applications.

MicroNote #705: *RF Frequency Linear Tuning Varactors.* Describes the use of variable capacitance diodes (varactors) as tuning capacitors in high frequency circuits.

MicroNote #706: *Low Distortion RF FM Generation and Detection Using Hyper-Abrupt Tuning Diodes.* Discusses how the excellent frequency vs. voltage linearity of LC tuned circuits makes hyper-abrupt tuning diodes a good choice for FM generation and detection.

MicroNote #707: *RF HF-VHF-UHF Voltage Controlled Oscillators using Hyper-Abrupt Tuning Diodes.* Assists VCO designers in achieving superior performance from hyper-abrupt tuning diodes.

MicroCurrents

RF Transistors for Avionics Applications: An introduction of Microsemi RF discrete semiconductor capabilities for avionics applications.

RF Transistors for Base Stations and Satellite Communications: An introduction of Microsemi RF discrete semiconductor capabilities for base station and satellite communications applications.

RF Channel Characteristics of Wireless Nomadic Systems: Discusses the distinction of RF channel characteristics between wireline and wireless communications.

www.Microsemi.com

a network of semiconductor technology

http://www.microsemi.com/

Application support

our products

Transient Suppression

- ESD Protection
- Lightning Suppression
- Low Cap High Speed
- Modular Solutions

Applications

- *Mobile Phones*
- *USB Port Protection*
- *Gigabit Ethernet*
- *Cable Modems*
- *Fiber Optic Repeaters*
- *Implantable Medical*

RF/Microwave/Opto

- InGaP Power Amplifiers
- Broadband Diodes
- RF Power Transistors

Applications

- *Mobile Phones/Radios*
- *Base Stations*
- *Cable Modems*
- *Wireless LAN*

Power Management

- LCD Backlight Drivers
- Class D Audio
- Pentium Switchers
- Low Dropout Regulators
- SCSI Terminators

Applications

- *Handheld Computers*
- *Notebooks/Desktops*
- *Hearing Aids*
- *Implantable Medical*

Power Conditioning

- Diodes and Rectifiers
- Zeners and Regulators
- Reference Diodes
- Current Limiters
- Transistors and SCRs
- MOSFETs and IGBTs

Applications

- *Mobile Phones*
- *Battery Chargers*
- *Power Supplies*
- *Fiber Optic Repeaters*
- *Satellites*
- *Implantable Medical*

www.Microsemi.com

a network of semiconductor technology

Microsemi Corporation
11861 Western Avenue
Garden Grove, CA 92841