

# DATA SHEET

## **SA910**

Variable gain RF predriver amplifier

Product specification

1997 Aug 12

# Variable gain RF predriver amplifier

# SA910

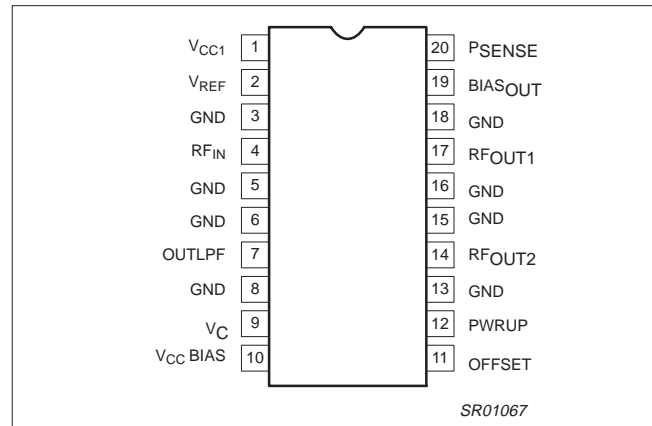
## DESCRIPTION

The SA910 is a variable gain predriver amplifier designed for handheld analog cellular telephones. When used with a UHF power transistor, it forms a cost-effective, low-profile, surface mount power amplifier solution (1.2W maximum PAE > 50%). The SA910 integrates power detection and control circuitry that is stabilized over temperature and voltage. In power down mode, the SA910 draws less than 10 $\mu$ A of current. The SA910 is fabricated using Philips QUBiC BiCMOS process.

## FEATURES

- MMIC BiCMOS predriver amplifier
- Low voltage 2.7 to 5.5V single supply operation
- 820 to 905MHz bandwidth
- High power gain >20dB
- High power output >23dBm (typical) @ 3V
- Efficiency = 35% (typical)
- Wide gain control range: >32dB
- Few external components required
- Integrated power detector and comparison gain control circuitry
- 50 $\Omega$  input, open-collector output
- SSOP-20 package
- Integrated regulator with offset adjustment for biasing an external output stage

## PIN CONFIGURATION



## APPLICATIONS

- 900MHz analog cellular
- Handheld transmitting equipment in the 820 to 905MHz frequency range
- Cordless phone

# Variable gain RF predriver amplifier

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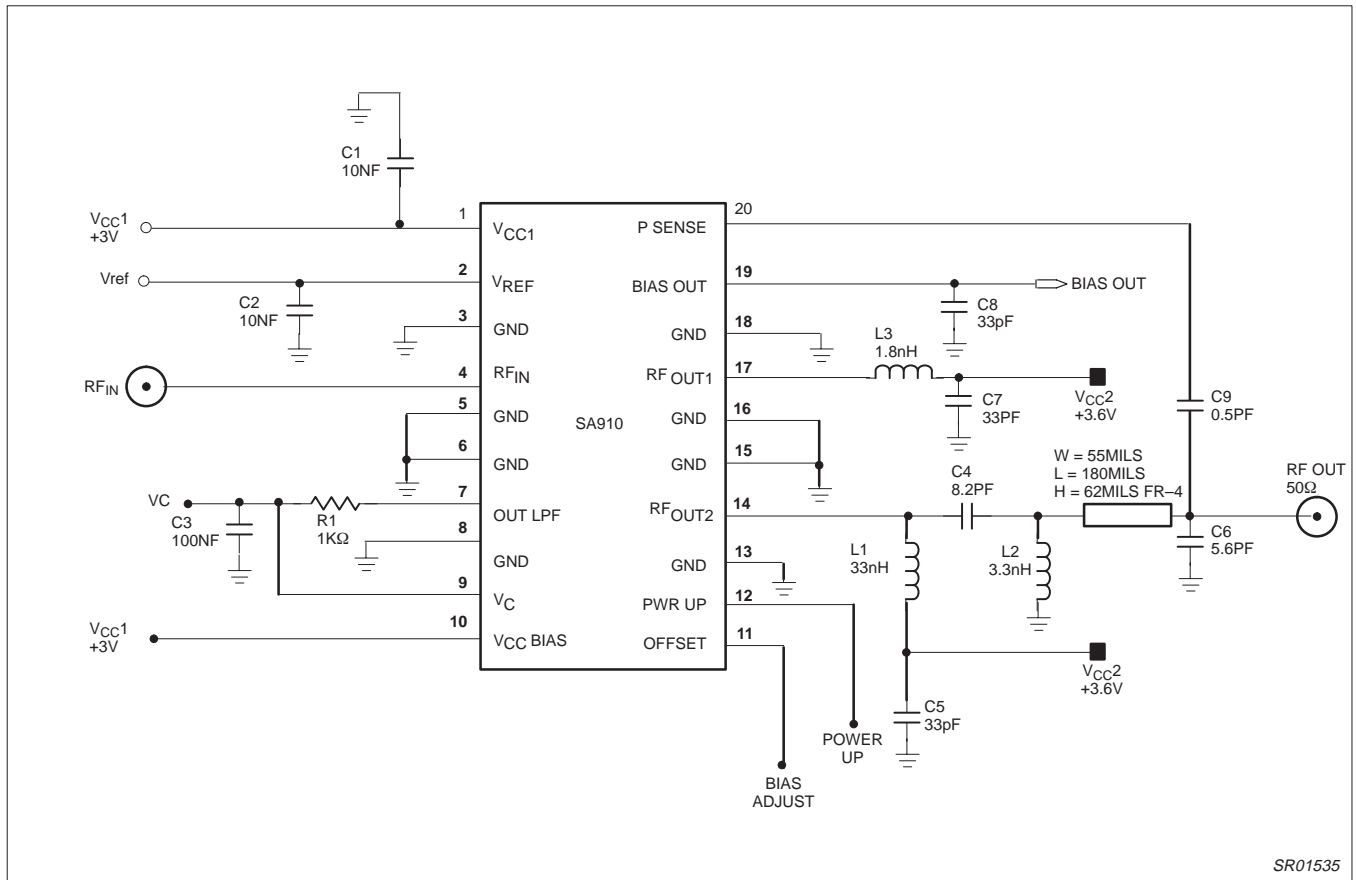


Figure 1. Application Diagram

## ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
20-Pin Plastic SSOP (Shrink Small Outline Package)	-40 to +85°C	SA910	SOT266-1

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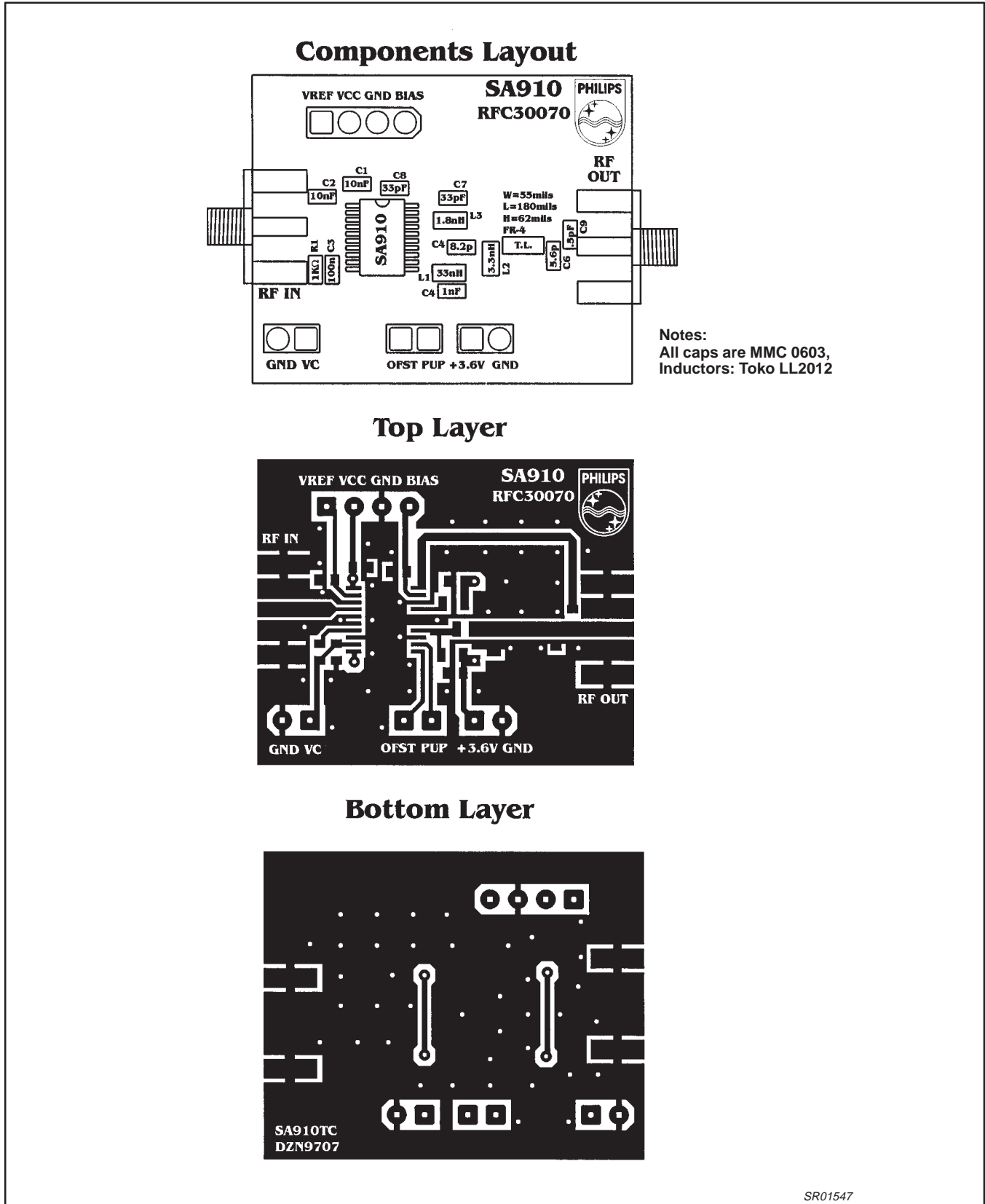


Figure 2. Application Board Layout of SA910

SR01547

# Variable gain RF predriver amplifier

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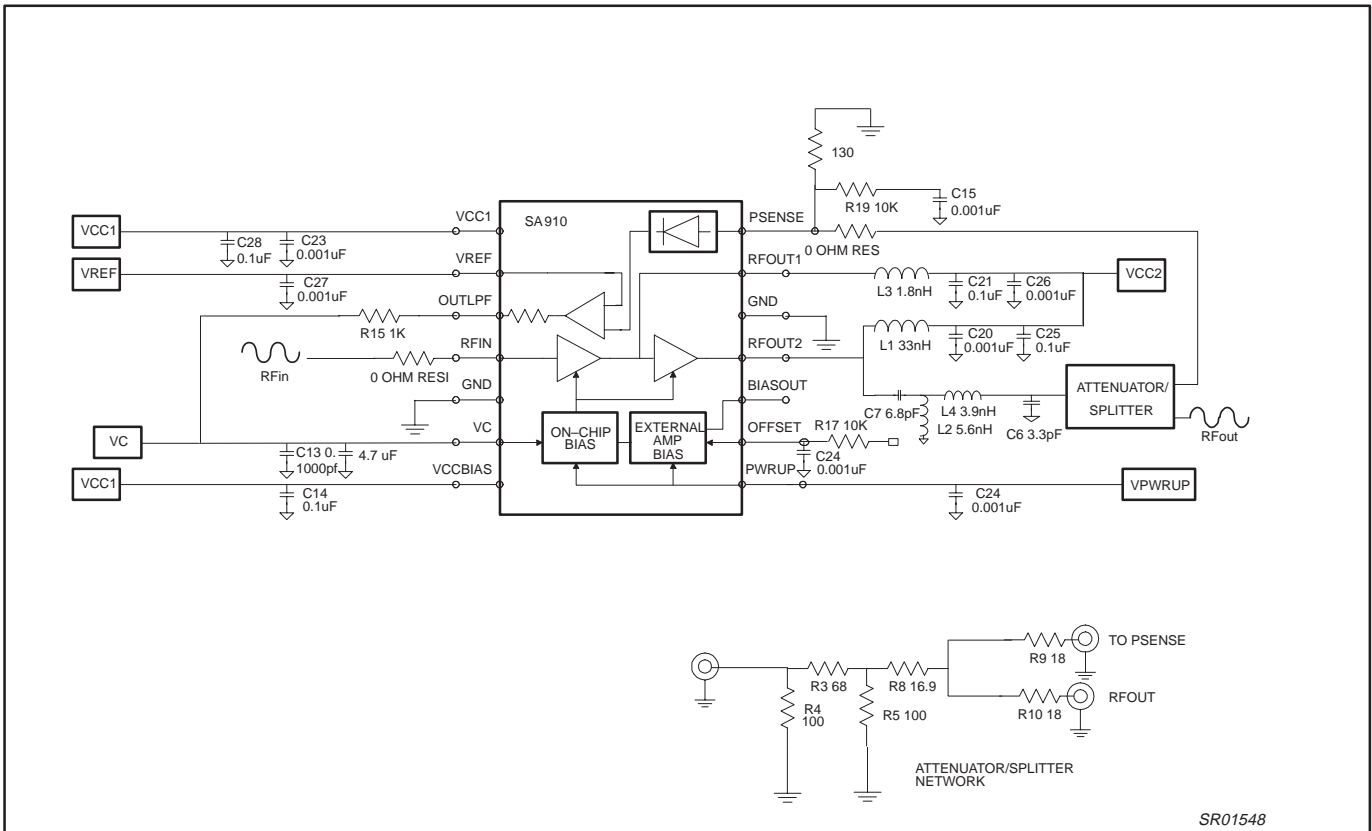


Figure 3. Test Circuit Used In Characterizing SA910

## BLOCK DIAGRAM

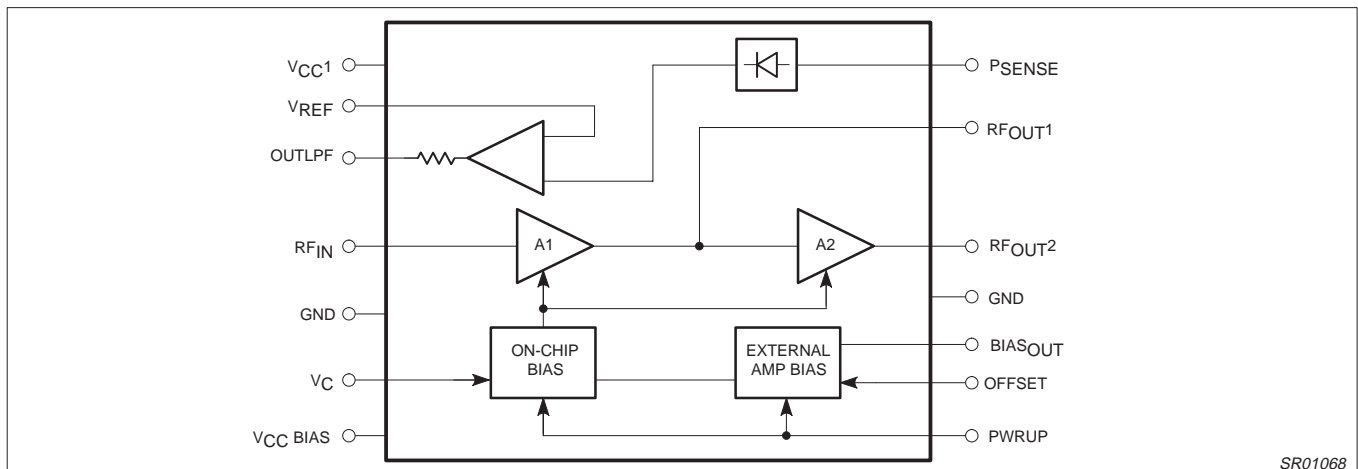


Figure 4. Block Diagram

## Variable gain RF predriver amplifier

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## PIN DESCRIPTIONS

Pin No.	Mnemonic	Function
1	V <sub>CC1</sub>	Power supply for power sense loop and off-chip bias
2	V <sub>REF</sub>	Power sense reference voltage input
3	GND	Ground
4	RF <sub>IN</sub>	Pre-driver input
5	GND	Ground
6	GND	Ground
7	OUTLPF	Power sense detected output
8	GND	Ground
9	VC	Gain control input
10	V <sub>CC</sub> BIAS	Power supply for on-chip bias
11	OFFSET	External power amp bias offset adjustment
12	PWRUP	Power-up input
13	GND	Ground
14	RF <sub>OUT2</sub>	Pre-driver output (open collector)
15	GND	Ground
16	GND	Ground
17	RF <sub>OUT1</sub>	Output of first stage (open collector)
18	GND	Ground
19	BIAS <sub>OUT</sub>	Output to bias external power amplifier stage
20	P <sub>SENSE</sub>	Power sense input

## ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNITS
V <sub>CC1</sub> /V <sub>CCBIAS</sub>	DC supply voltages	-0.3 to +6.0	V
	Voltage applied to any other pin <sup>1</sup>	-0.3 to (V <sub>CC1</sub> + 0.3)	V
P <sub>D</sub>	Power dissipation	1.0	W
P <sub>IN</sub>	Input drive power	5	mW
P <sub>DET</sub>	Input detect power	20	mW
P <sub>L</sub>	Load power	500	mW
T <sub>STG</sub>	Storage temperature range	-65 to +150	°C

## NOTE:

1. Except RF<sub>OUT1</sub> and RF<sub>OUT2</sub> which can have 8V max.

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	RATING	UNITS
V <sub>CC1</sub> /V <sub>CCBIAS</sub>	Supply voltage	3 to 3.6	V
T <sub>A</sub>	Operating ambient temperature range	-40 to +85	°C

## NOTE:

1. R<sub>th</sub> = 75° c/w

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**AC ELECTRICAL CHARACTERISTICS**

$V_{CC1} = V_{CCBIAS} = +3V$ ;  $V_{CC}(RF_{OUT1}, RF_{OUT2}) = 3.6V$ ;  $T_A = 25^\circ C$ ,  $Z_S = Z_L = 50\Omega$ ;  $V_C = 2V$ ;  $RF_{IN} = 0dBm$  @ 830MHz; unless otherwise stated.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNITS
			MIN	TYP	MAX	
$f_{RF}$	Frequency range		820	830	905	MHz
$P_L$	Load power at $RF_{OUT2}$	Saturated <sup>1</sup>	21.5	24		dBm
$S_{21}$	Small signal gain	$RF_{in} = -20dBm$		31		dB
$\eta$	Power added efficiency	$P_L = 24dBm$		35		%
$S_{11}$	Input return loss	$RF_{in} = 0dBm$		-12		dB
$G_C$	Gain control range from $V_C = 0.7$ to $2V$	$dP/dV < 120dB/V$	32			dB
$S_{12}$	Reverse isolation			-40		dB
GOFF	Gain at $RF_{OUT2}$ during power-down ( $RF_{IN} = -20dBm$ )			-30		dB
PSENSE	Power detector range			25		dB

**NOTE:**

- Needs proper output matching.

## Variable gain RF predriver amplifier

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**DC ELECTRICAL CHARACTERISTICS**

$V_{CC1} = V_{CCBIAS} = +3V$ ,  $V_{CC} (RF_{OUT1}, RF_{OUT2}) = 3.6V$ ;  $T_A = 25^\circ C$ ,  $Z_S = Z_L = 50\Omega$ , ; unless otherwise stated.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNITS
			MIN	-3 $\sigma$	TYP	+3 $\sigma$	MAX	
$V_{CC}$	Power supply voltage range		2.7		3.0		5.5	V
$I_{CC}$	Total DC current from all $V_{CC}$	Pin 12 = HIGH; Pin 9 > $V_{BE}$			210		300	mA
$I_{ZB}$	$I_{CC}$ under zero bias mode	Pin 12 = HIGH; Pin 9 < $V_{BE}$					0.7	mA
$I_{OFF}$	Powerdown current	Pin 12 = LOW					10	$\mu A$
$I_{PU}$	Input current to PWRUP	Pin 12 = HIGH					100	$\mu A$
		Pin 12 = LOW					10	
$V_{PU}$	Input level for PWRUP (Pin 12)	Pin 12 = LOW	0				$0.3V_{CC}$	V
		Pin 12 = HIGH	$0.7V_{CC}$				$V_{CC}$	V
$I_{REF}$	Input current to $V_{REF}$ (Pin 2)					1	$\mu A$	
$V_{REF}$	Power control reference voltage (Pin 1)		0				2.0	V
$V_{BIAS}$	Bias <sub>OUT</sub> voltage (Pin 19) (unadjusted)	$V_C = 2.0V$			0.68			V
$I_{BIAS}$	DC current available @ Bias-OUT (Pin 19)		30					mA
$V_C$	Control voltage (Pin 9) range		0				2	V



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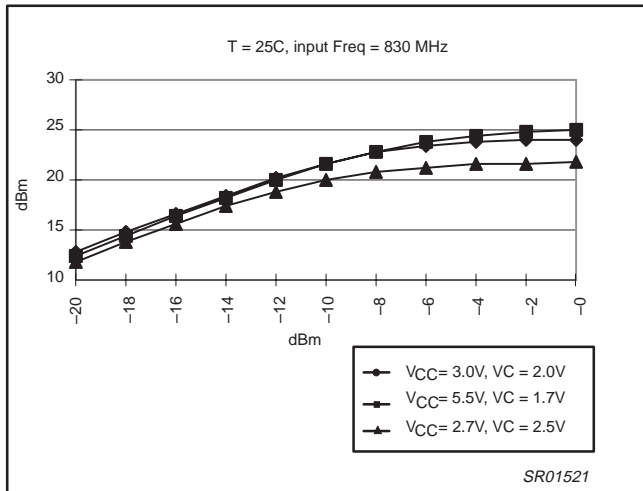


Figure 5. Output Power VS Input Power

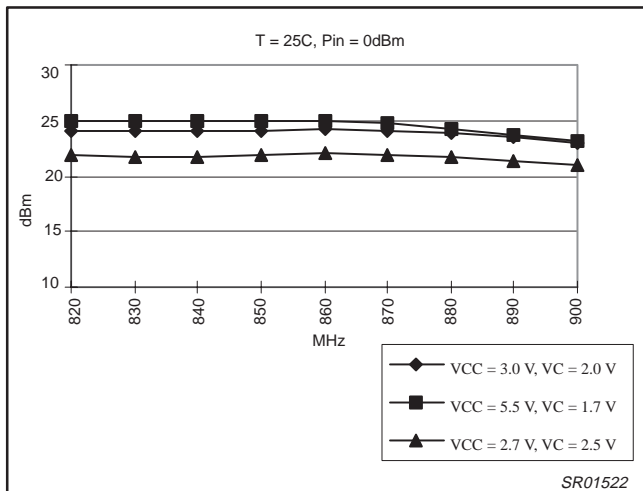


Figure 6. Output Power VS Input Frequency

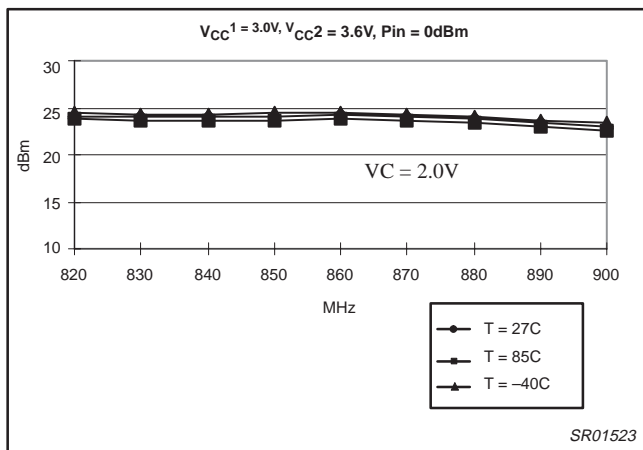


Figure 7. Output Power VS Input Frequency

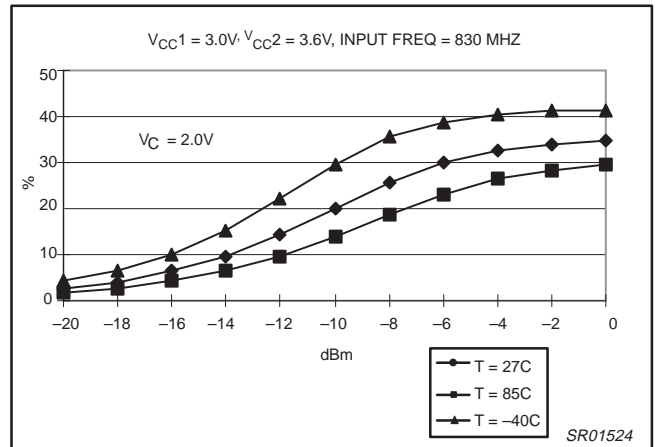


Figure 8. PAE VS Input Power

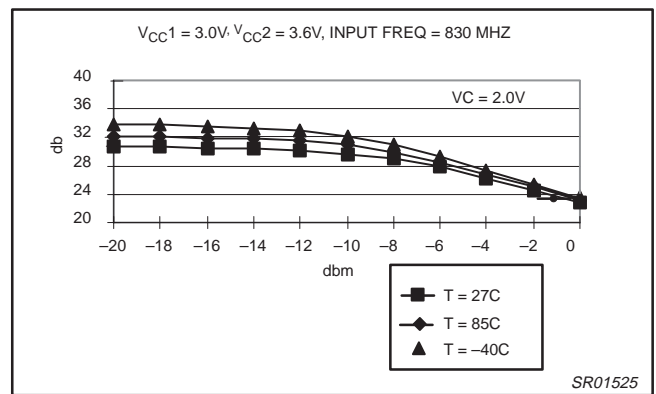


Figure 9. Signal Gain VS Input Power

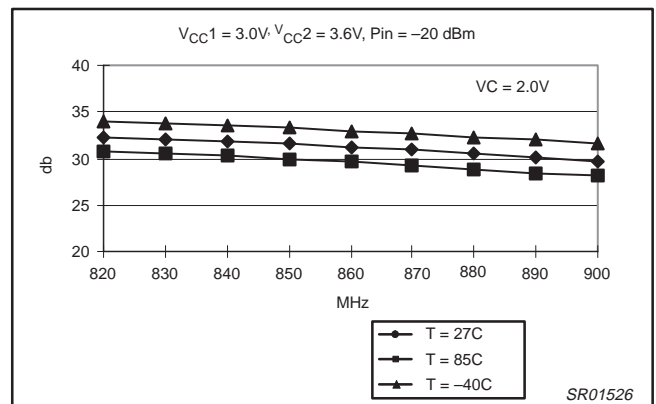


Figure 10. Signal Gain VS Input Frequency

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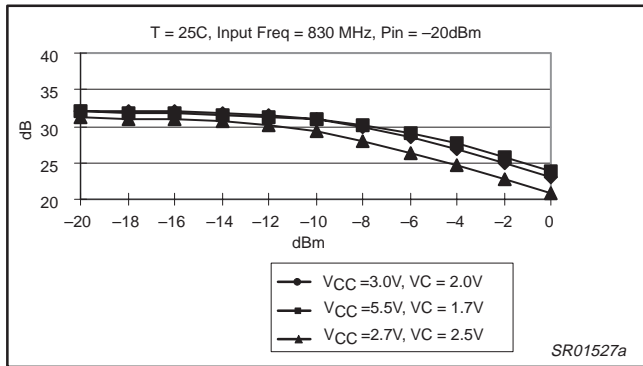


Figure 11. Signal Gain VS Input Power

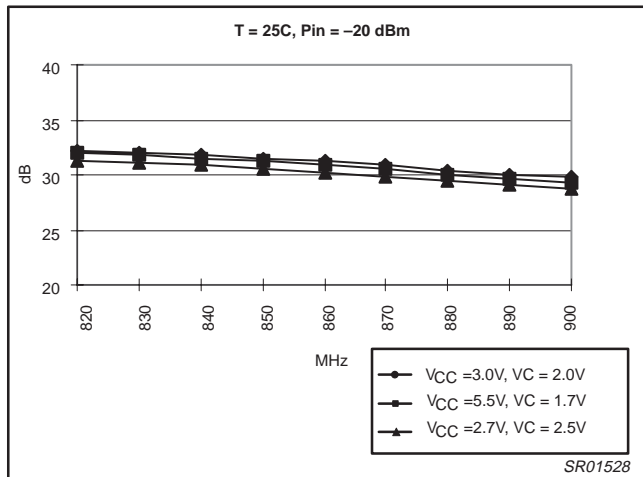


Figure 12. Signal Gain VS Input Frequency

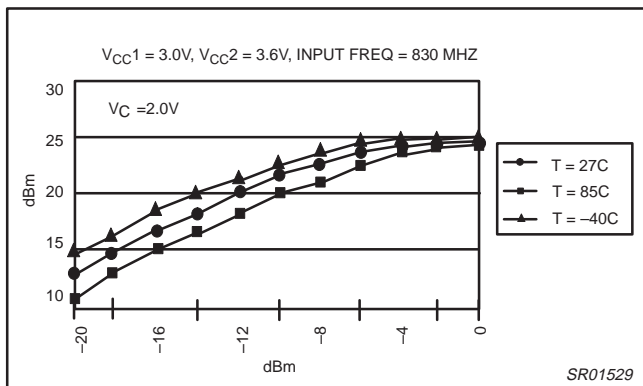


Figure 13. Output Power VS Input Power

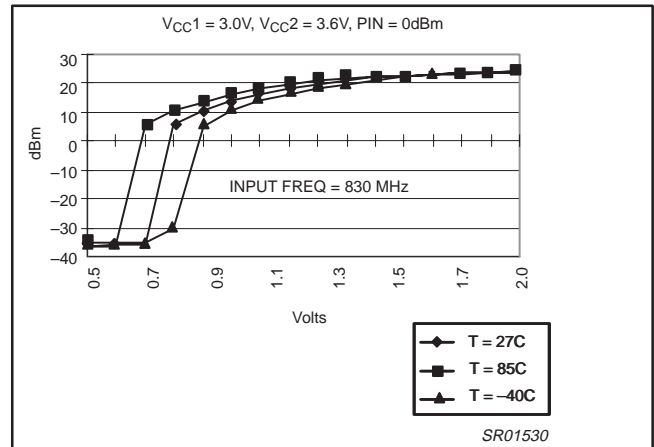


Figure 14. Output Power VS VC

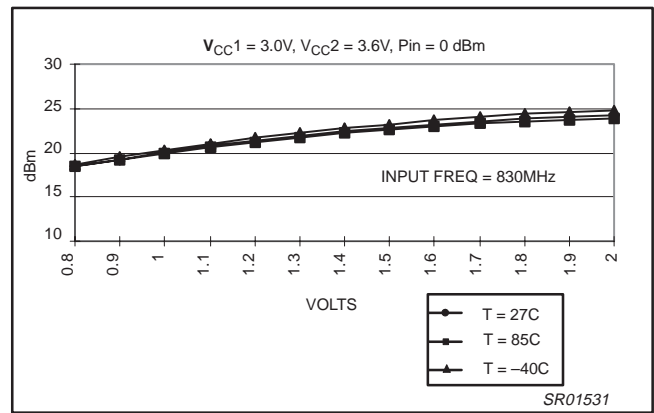


Figure 15. Output Power VS VREF (Closed Loop)

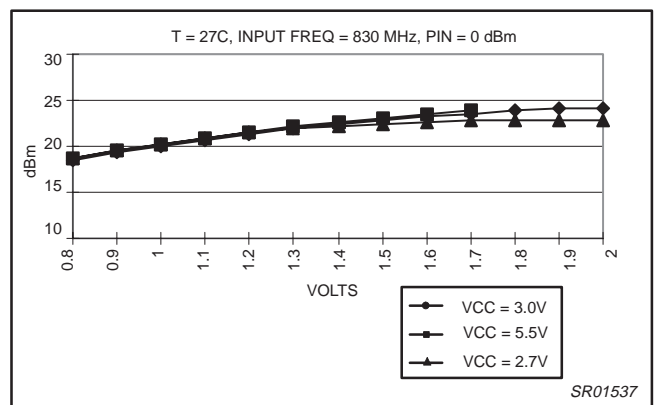


Figure 16. Output Power VS VREF (Closed Loop)

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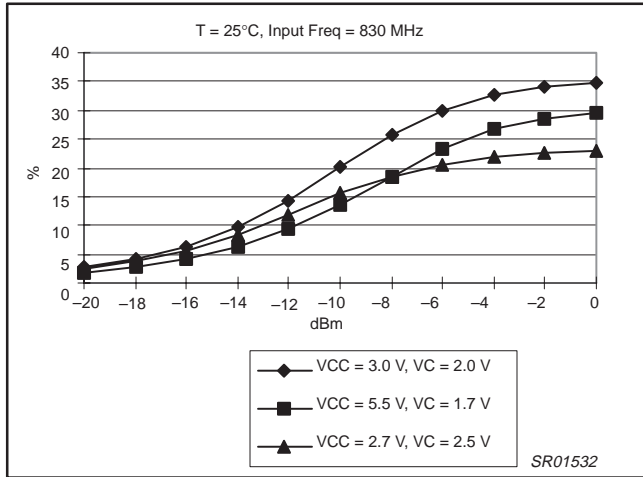


Figure 17. PAE VS Input Power

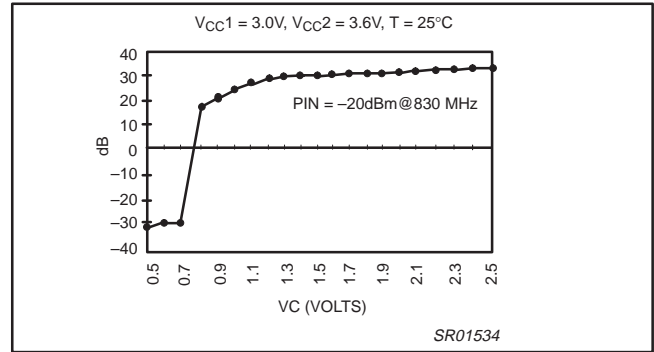


Figure 19. Small Signal Gain VS VC

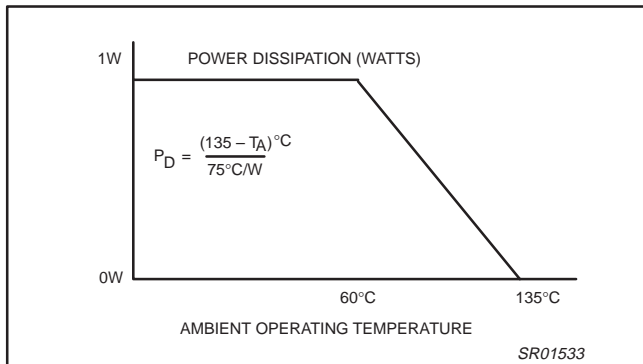


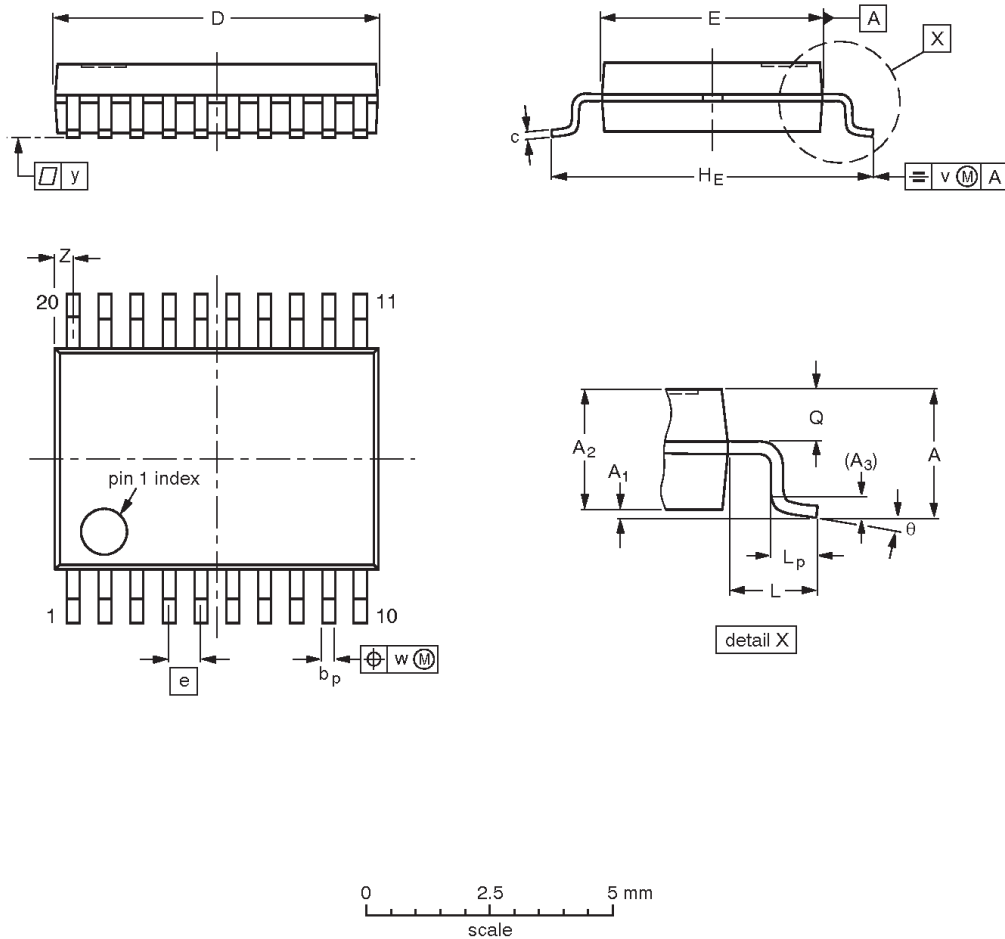
Figure 18. Power De-Rating Curve

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**SSOP20: plastic shrink small outline package; 20 leads; body width 4.4 mm**

**SOT266-1**



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	1.5	0.15 0	1.4 1.2	0.25	0.32 0.20	0.20 0.13	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.45	0.65 0.45	0.2	0.13	0.1	0.48 0.18	10° 0°

**Note**

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT266-1						90-04-05 95-02-25

## Variable gain RF predriver amplifier

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## Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

[1] Please consult the most recently issued datasheet before initiating or completing a design.

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