MAX2090

50MHz to 1000MHz Analog VGA and Power Detector with Optional AGC Loop

General Description

The MAX2090 high-linearity analog variable-gain amplifier (VGA) is a monolithic SiGe BiCMOS attenuator, amplifier, and RMS detector designed to interface with 50Ω systems operating in the 50MHz to 1000MHz frequency range. Either the on-board RMS power detector or an external analog control voltage controls the analog attenuator. The device features a gain range of -11.5dB to +25.5dB, a noise figure of 4dB, OIP3 linearity of +38dBm, and a wide RF bandwidth. Each of these features makes the device an ideal VGA for numerous receiver and transmitter applications. In addition, the device operates from a single +5.0V supply.

This device is available in a compact 20-pin TQFN package (5mm x 5mm) with an exposed pad. Electrical performance is guaranteed over the extended temperature range, from T_C = -40°C to +95°C.

Applications

Point-to-Point Receivers and Transmitters

RF/IF Variable-Gain Stages

Temperature-Compensation Circuits

Cellular Applications

WiMAX™ Applications

LTE Applications

Fixed Broadband Wireless Access

Wireless Local Loop

Military Systems

Benefits and Features

- **Wideband Coverage**
  - **50MHz to 1000MHz RF Frequency Range**
- **High Linearity**
  - **+38dBm OIP3 (Detector Disabled, 100MHz)**
  - **+37.3dBm OIP3 (Detector Enabled, 100MHz)**
  - **+17.5dBm Output -1dB Compression Point (100MHz)**
- **25.5dB Gain**
- **37dB Attenuator Range**
- **4dB Noise Figure (Includes Attenuator Insertion Loss)**
- **0.25dB Gain Variation Over 100MHz Bandwidth**
- **Analog Attenuator Controlled with External Voltage or On-Chip RMS Power Detector**
- **Power Level Set Capable Using On-Chip RMS Detector in Closed-Loop Mode**
- **Power Detector Alarm Circuit with Adjustable Threshold**
- **Extended +4.75V to +5.8V Supply Range**
- **Lead(Pb)-Free Package**
- **Power-Down Capabilities**

***Ordering Information* appears at end of data sheet.**

For related parts and recommended products to use with this part, refer to: ***www.maxim-ic.com/MAX2090.related***

ABSOLUTE MAXIMUM RATINGS

V_{CC_A}, V_{CC_RF}..-0.3V to +6V
RF_IN, RF_OUT .... -0.3V to (V_{CC} + 0.3V)
R_BIAS, ALM_THRES, PLVLSET,
GCTRL, FLTR ....-0.3V to +3.6V
CTRL1, CTRL2 ....-0.3V to +3.6V
ALM ....-0.3V to +3.6V
DET_VOUT ....-0.3V to +3.6V
RF_IN Input Power .... +15dBm
RF_OUT Output Power ....+20dBm
DET_IN Input AC Voltage Swing .... -0.3V to (V_{CC} + 3.0V)
Continuous Power Dissipation (Note 1) 2.5W
Operating Case Temperature Range (Note 2) .. -40°C to +95°C
Maximum Junction Temperature...................................+150°C
Storage Temperature Range........................... -65°C to +150°C
Lead Temperature (soldering, 10s) ....+300°C
Soldering Temperature (reflow) ....+260°C

Note 1: Based on junction temperature $T_J = T_C + (\theta_{JC} \times V_{CC} \times I_{CC})$. This formula can be used when the temperature of the exposed pad is known while the device is soldered down to a PCB. See the *Applications Information* section for details. The junction temperature must not exceed +150°C.

Note 2: T_C is the temperature on the exposed pad of the package. T_A is the ambient temperature of the device and PCB.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

PACKAGE THERMAL CHARACTERISTICS

TQFN
Junction-to-Ambient Thermal Resistance θ_{JA} (Notes 3, 4)..+29°C/W
Junction-to-Case Thermal Resistance θ_{JC} (Notes 1, 4).........7°C/W

Note 3: Junction temperature $T_J = T_A + (\theta_{JA} \times V_{CC} \times I_{CC})$. This formula can be used when the ambient temperature of the PCB is known. The junction temperature must not exceed +150°C.

Note 4: Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to **www.maxim-ic.com/thermal-tutorial**.

DC ELECTRICAL CHARACTERISTICS

(*Typical Application Circuit*, V_{CC} = 4.75V to 5.8V, V_{GND} = 0V, and T_C = -40°C to +95°C. Typical values are at V_{CC} = 5.0V, $V_{PLVLSET}$ = 1.65V, and T_C = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V_{CC}		4.75	5.0	5.8	V
Total Supply Current	I_{DC}	CTRL1 = X, CTRL2 = 1		85	110	mA
		CTRL1 = 1, CTRL2 = 0		75	100	
		CTRL1 = 0, CTRL2 = 0		8	15	
CTRL1/CTRL2 Logic-Low Input Voltage	V_{IL}				0.8	V
CTRL1/CTRL2 Logic-High Input Voltage	V_{IH}		2.2			V
CTRL1/CTRL2 Input Logic Current	I_{IH}, I_{IL}		-10		+10	µA
PLVLSET Input Resistance	R_{IN}		650			kΩ
PLVLSET Input Voltage Range			0		2.5	V
PLVLSET Minimum Control Voltage			0	0.1	0.2	V

DC ELECTRICAL CHARACTERISTICS (continued)

(*Typical Application Circuit*, V_{CC} = 4.75V to 5.8V, V_{GND} = 0V, and T_C = -40°C to +95°C. Typical values are at V_{CC} = 5.0V, $V_{PLVLSET}$ = 1.65V, and T_C = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
PLVLSET Maximum Control Voltage			2.3	2.4	2.5	V
ALM_THRES Input Resistance			90	135		kΩ
ALM_THRES Input Voltage Range		(Note 5)	0		2.5	V
ALM Output Logic 1			3.135	3.3	3.465	V
ALM Output Logic 0					0.4	V
DET_IN Input Resistance			60	100		kΩ
DET_VOUT Output Resistance			175	235	295	kΩ

RECOMMENDED AC OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RF Frequency	f_{RF}	(Note 6)	50		1000	MHz
RF Input Power Range	P_{RFIN}	ALC closed loop, CTRL1 = CTRL2 = 1 (Note 6)	-30		+1	dBm
RMS Detector Input Power Range		ALC open loop, CTRL1 = 0, CTRL2 = 1 (Note 6)	-30		+14	dBm

AC ELECTRICAL CHARACTERISTICS

(*Typical Application Circuit* with analog attenuator set to minimum attenuation, V_{CC} = 4.75V to 5.8V, f_{RF} = 350MHz, -40°C < T_C < +95°C, and RF ports are connected to 50Ω sources, unless otherwise noted. Typical values are at T_C = +25°C, V_{CC} = 5.0V, P_{RF_IN} = -25dBm, $V_{PLVLSET}$ = 2.5V, CTRL1 = 0, CTRL2 = 1. Min/max specifications apply over supply, process, and temperature, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal Gain	G	T_C = +25°C, V_{CC} = 5.0V (Note 5)	24.5	25.5	26.5	dB
		(Note 8)	23.5	25.5	27.5	
Gain vs. Temperature				-0.004		dB/°C
Maximum Gain Variation vs. Frequency		f_{RF} ±50MHz		0.25		dB
		f_{RF} ±80MHz		0.4		
		f_{RF} ±100MHz		0.5		
Noise Figure	NF	(Note 5)		4	5.7	dB
Total Attenuation Range		$V_{PLVLSET}$ = 0.2V to 2.5V (Note 8)	35	37		dB
Group-Delay Variation		Within ±50MHz		150		ps
		Within ±80MHz		250		
		Within ±100MHz		300		

AC ELECTRICAL CHARACTERISTICS (continued)

(*Typical Application Circuit* with analog attenuator set to minimum attenuation, V_{CC} = 4.75V to 5.8V, f_{RF} = 350MHz, -40°C < T_C < +95°C, and RF ports are connected to 50Ω sources, unless otherwise noted. Typical values are at T_C = +25°C, V_{CC} = 5.0V, P_{RF_IN} = -25dBm, $V_{PLVLSET}$ = 2.5V, CTRL1 = 0, CTRL2 = 1. Min/max specifications apply over supply, process, and temperature, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Third-Order Intercept Point (Note 5)	OIP3	$V_{PLVLSET}$ = 2.5V, P_{RF_OUT} = 0dBm/tone, f_{RF2} - f_{RF1} = 1MHz	31.8	36.5		dBm
		$V_{PLVLSET}$ = 0.7V, P_{RF_OUT} = 0dBm/tone, f_{RF2} - f_{RF1} = 1MHz	31.8	36.5		
Output Second-Order Intercept Point	OIP2	P_{RF_OUT} = 0dBm/tone, f_{RF2} - f_{RF1} = 1MHz, f_{RF_OUT} = f_{RF2} + f_{RF1}		56.7		dBm
Output Second Harmonic		P_{RF_OUT} = 0dBm		61.4		dBc
Output Third Harmonic		P_{RF_OUT} = 0dBm		72.8		dBc
Output -1dB Compression Point	P_{1dB}	(Notes 8, 9)	14	17.2		dBm
Average Gain-Control Slope		$V_{PLVLSET}$ = 0.5V to 2.0V (Note 5)	16.5	19.5	23.0	dB/V
Maximum Gain-Control Slope		$V_{PLVLSET}$ = 0 to 2.5V		25		dB/V
VGA Reverse Isolation				35		dB
Attenuator Response Time		P_{RF_IN} = -15dBm, $V_{PLVLSET}$ = 2.5V to 1.2V, output settled within ±0.5dB of final value		330		ns
		P_{RF_IN} = -15dBm, $V_{PLVLSET}$ =1.2V to 2.5V, output settled within ±0.5dB final value		220		
Insertion Phase Change		$V_{PLVLSET}$ = 2.5V to 0V		11		Degrees
RMS Detector Slope				55		mV/dB
RMS Detector ±0.25dB Accuracy Dynamic Range				25		dB
Power-Detector Variation Due to Temperature		T_C = +25°C to -40°C		-0.4		dB
		T_C = +25°C to +95°C		0.1		
RF_IN Return Loss		Z_S = 50Ω, over full attenuation range (Note 5)	13.5	20		dB
RF_OUT Return Loss		Z_L = 50Ω over full attenuation range (Note 5)	13.5	20		dB
POWER DETECTOR/AGC LOOP (CTRL1 = CTRL2 = 1, P_{RF_IN} = -15dBm, $V_{PLVLSET}$ = 1.65V)						
Maximum Output Power Variation vs. Modulation Level		4 QAM–256 QAM, T_C = +25°C (Note 10)		±0.5		dB
Maximum Output Power Variation vs. Temperature		-40°C ≤ T_C ≤ +95°C (Note 11)		±0.5		dB

AC ELECTRICAL CHARACTERISTICS (continued)

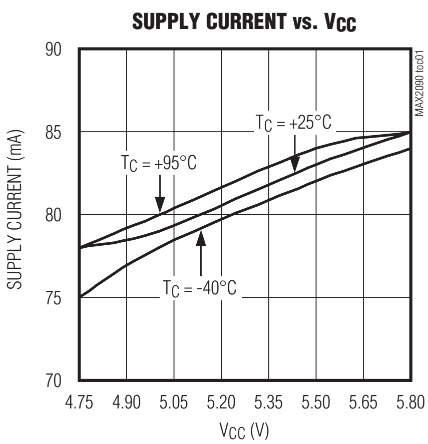
(*Typical Application Circuit* with analog attenuator set to minimum attenuation, V_{CC} = 4.75V to 5.8V, f_{RF} = 350MHz, -40°C < T_C < +95°C, and RF ports are connected to 50Ω sources, unless otherwise noted. Typical values are at T_C = +25°C, V_{CC} = 5.0V, P_{RF_IN} = -25dBm, $V_{PLVLSET}$ = 2.5V, CTRL1 = 0, CTRL2 = 1. Min/Max specifications apply over supply, process, and temperature, unless otherwise noted.) (Note 7)

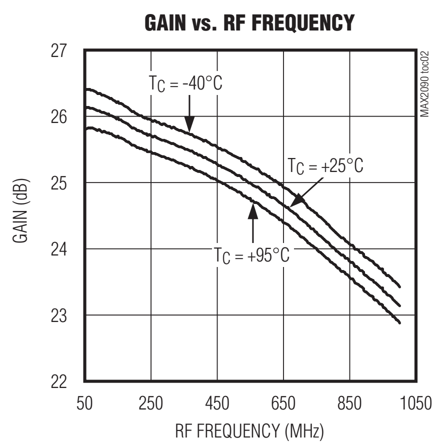
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
AGC Loop-Settling Time (Note 12)		C8 = 47nF		10		ms
		C8 = 100nF		22		
		C8 = 470nF		100		
DET_IN Input Impedance				500		Ω
Maximum GCTRL Capacitance to GND		(Note 5)			20	pF
ALARM CIRCUIT (CTRL1 = CTRL2 = 1)						
ALM Threshold		ALM_THRES open (see Table 2)		-30		dBm

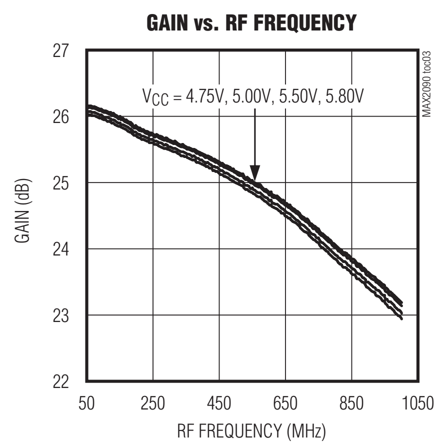
Note 5: Guaranteed by design and characterization.
Note 6: Recommended functional range. Not production tested. Operation outside this range is possible, but with degraded performance of some parameters.
Note 7: All limits include external component losses. Output measurements were taken at the RF_OUT port.
Note 8: Production tested and guaranteed at T_C = +95°C for worst-case supply voltage. Performance at T_C = +25°C and T_C = -40°C are guaranteed by design and characterization for worst-case supply voltage.
Note 9: It is advisable not to continuously operate the RF_IN input power above 11dBm, RF_OUT power above 19dBm, and DET_IN input AC voltage swing above ±V_{CC}/2.
Note 10: Output power variation after system calibration of (CW) output power vs. $V_{PLVLSET}$ at T_C = +25°C.
Note 11: Output power variation after system calibration using temperature profile of (CW) output power vs. $V_{PLVLSET}$ with -40°C ≤ T_C ≤ 95°C.
Note 12: Settling time to 63% of final output power due to RF_IN 6dB power step.

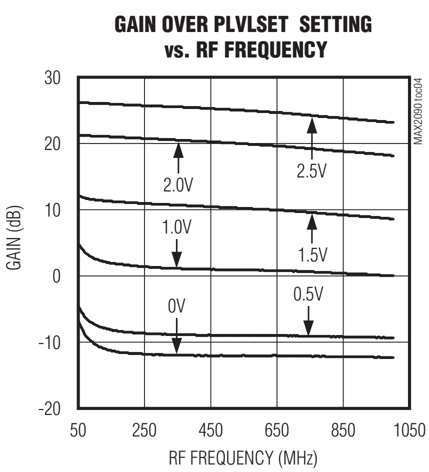
Typical Operating Characteristics

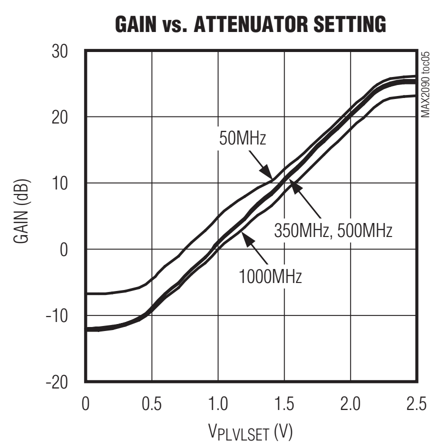
(*Typical Application Circuit* with analog attenuator set to minimum attenuation ($V_{PLVLSET}$ = 2.5V), V_{CC} = 5.5V, T_C = +25°C, f_{RF_IN} = 350MHz, P_{RF_IN} = -25dBm, R_{SOURCE} = R_{LOAD} = 50Ω, CTRL1 = 0, CTRL2 = 1, ALM_THRES = ALM = open, unless otherwise noted.)

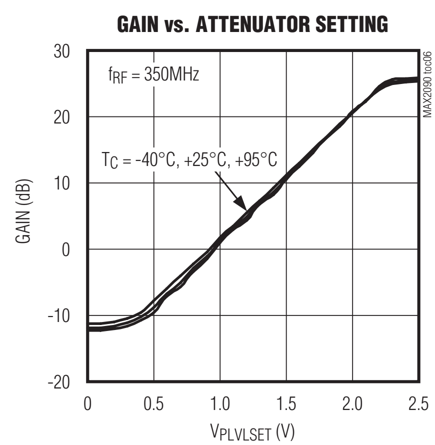








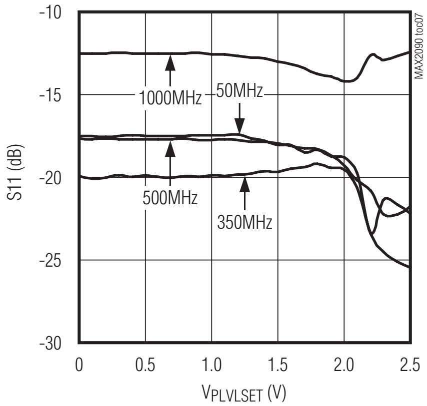




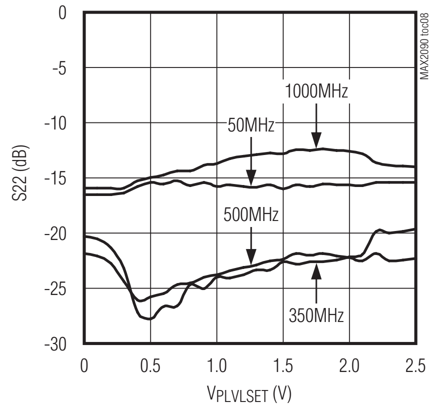
Typical Operating Characteristics (continued)

(*Typical Application Circuit* with analog attenuator set to minimum attenuation ($V_{PLVLSET}$ = 2.5V), V_{CC} = 5.5V, T_C = +25°C, f_{RF_IN} = 350MHz, P_{RF_IN} = -25dBm, R_{SOURCE} = R_{LOAD} = 50Ω, CTRL1 = 0, CTRL2 = 1, ALM_THRES = ALM = open, unless otherwise noted.)

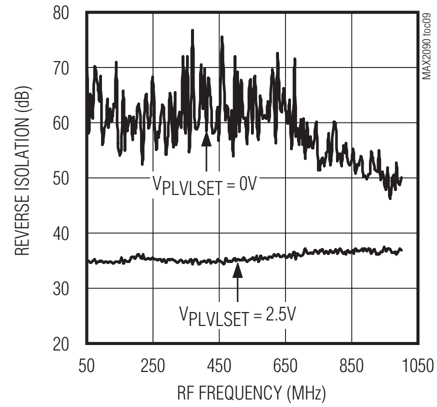
INPUT MATCH vs. ATTENUATOR SETTING



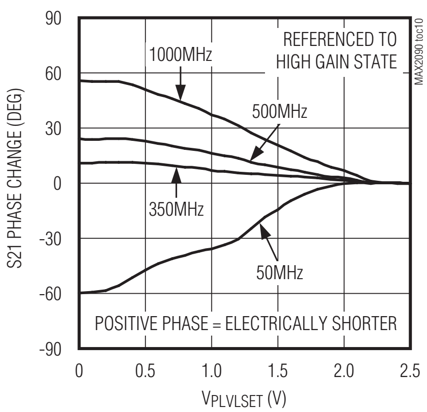
OUTPUT MATCH vs. ATTENUATOR SETTING



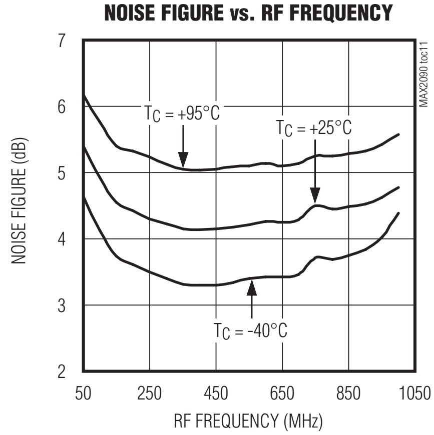
REVERSE ISOLATION OVER ATTENUATOR SETTING vs. RF FREQUENCY



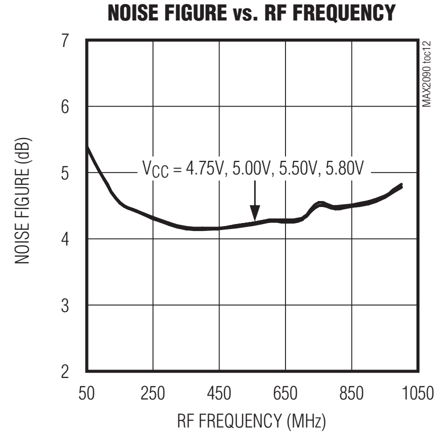
S21 PHASE CHANGE vs. ATTENUATOR SETTING



NOISE FIGURE vs. RF FREQUENCY

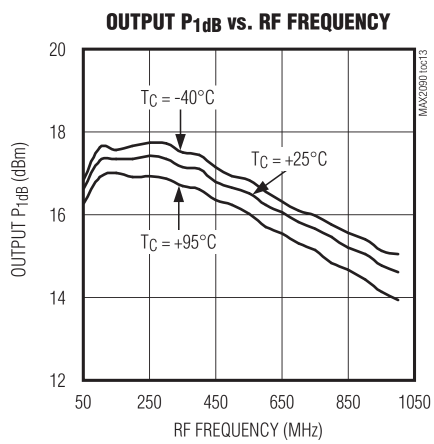


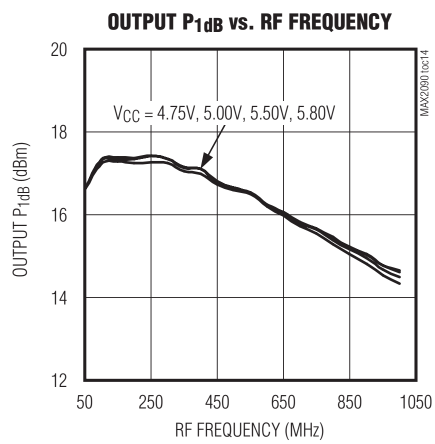
NOISE FIGURE vs. RF FREQUENCY

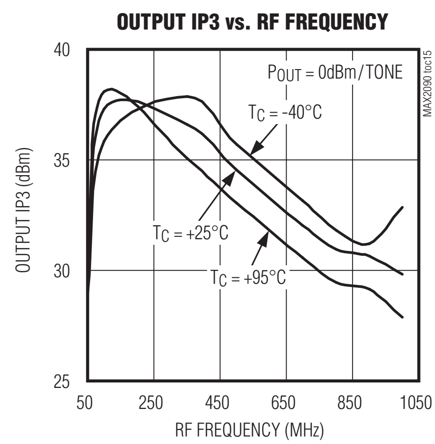


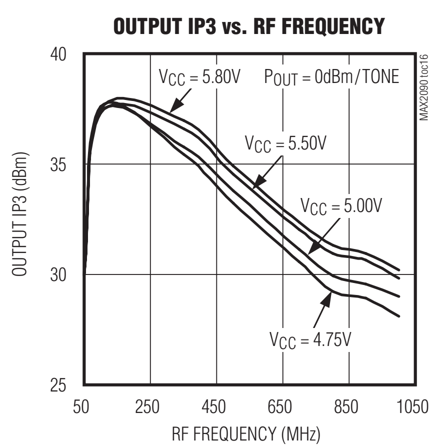
Typical Operating Characteristics (continued)

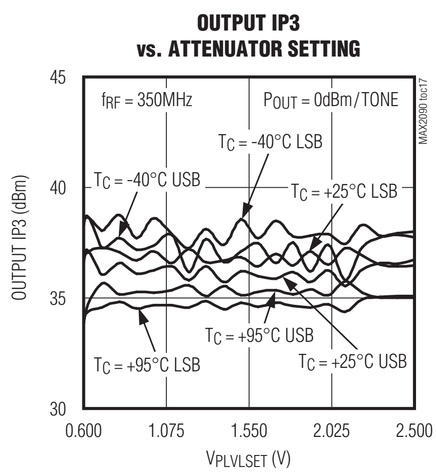
(*Typical Application Circuit* with analog attenuator set to minimum attenuation ($V_{PLVLSET}$ = 2.5V), V_{CC} = 5.5V, T_C = +25°C, f_{RF_IN} = 350MHz, P_{RF_IN} = -25dBm, R_{SOURCE} = R_{LOAD} = 50Ω, CTRL1 = 0, CTRL2 = 1, ALM_THRES = ALM = open, unless otherwise noted.)

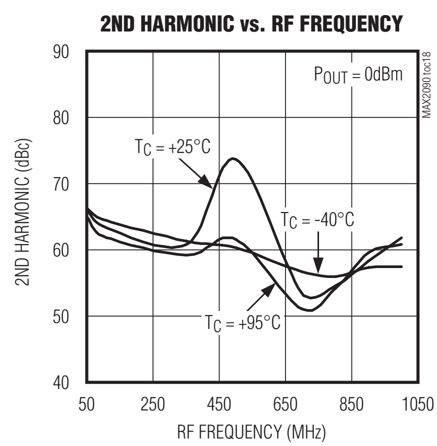






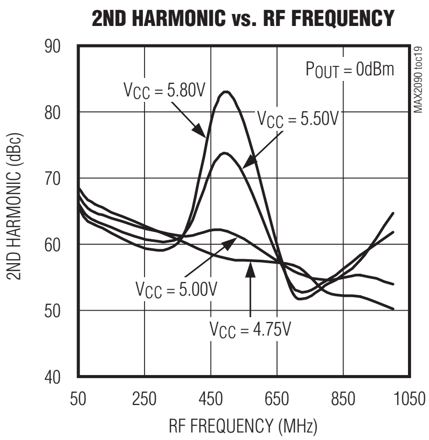


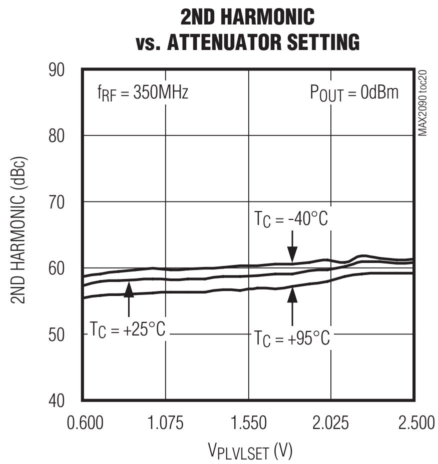


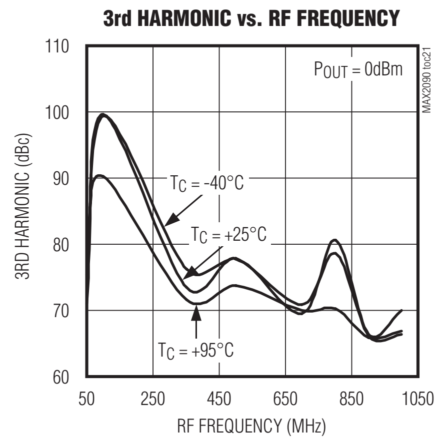


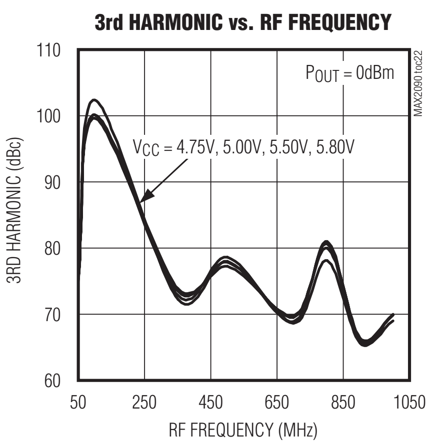
Typical Operating Characteristics (continued)

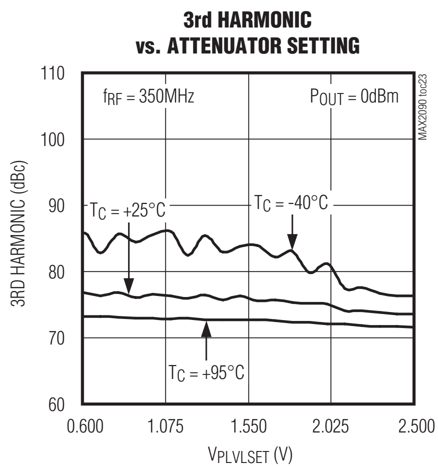
(*Typical Application Circuit* with analog attenuator set to minimum attenuation ($V_{PLVLSET}$ = 2.5V), V_{CC} = 5.5V, T_C = +25°C, f_{RF_IN} = 350MHz, P_{RF_IN} = -25dBm, R_{SOURCE} = R_{LOAD} = 50Ω, CTRL1 = 0, CTRL2 = 1, ALM_THRES = ALM = open, unless otherwise noted.)

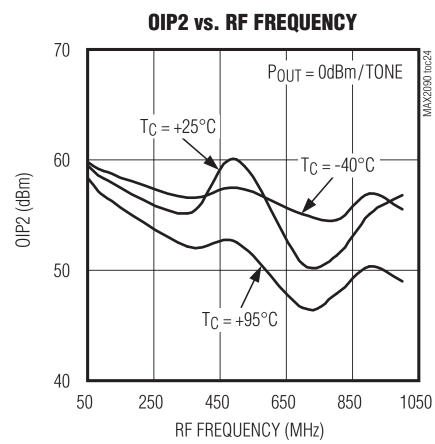








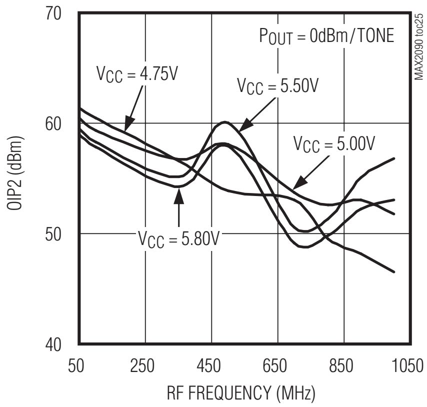




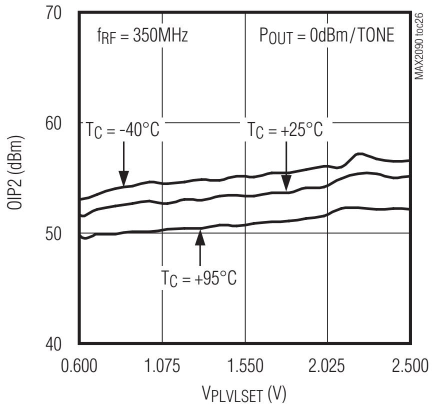
Typical Operating Characteristics (continued)

(*Typical Application Circuit* with analog attenuator set to minimum attenuation ($V_{PLVLSET}$ = 2.5V), V_{CC} = 5.5V, T_C = +25°C, f_{RF_IN} = 350MHz, P_{RF_IN} = -25dBm, R_{SOURCE} = R_{LOAD} = 50Ω, CTRL1 = 0, CTRL2 = 1, ALM_THRES = ALM = open, unless otherwise noted.)

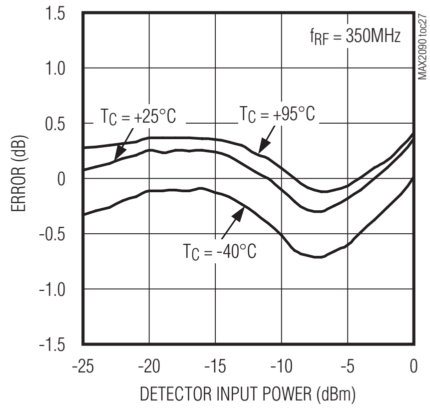
OIP2 vs. RF FREQUENCY



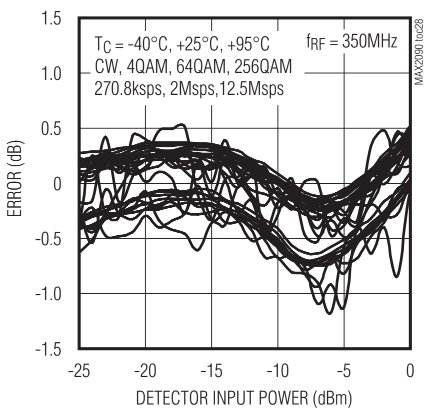
OIP2 vs. ATTENUATOR SETTING



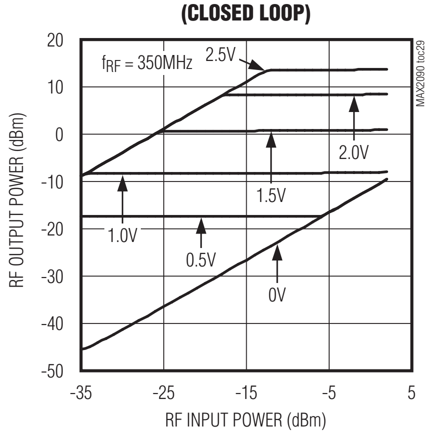
DETECTOR ERROR FROM ONE IDEAL LINE (CW SIGNAL)



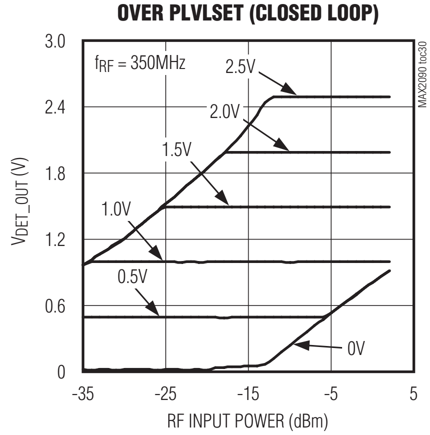
DETECTOR ERROR FROM ONE IDEAL LINE OVER TEMPERATURE MODULATION TYPE AND DATA RATE



RF OUTPUT POWER vs. RF INPUT POWER OVER PLVLSET (CLOSED LOOP)



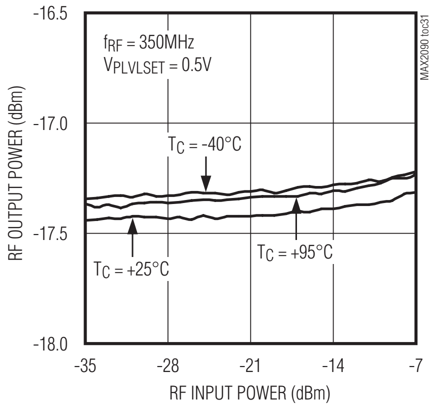
VDET_OUT vs. RF INPUT POWER OVER PLVLSET (CLOSED LOOP)



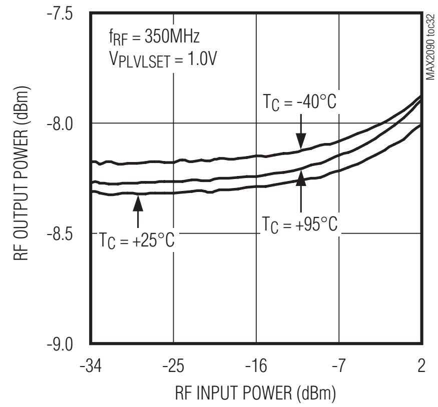
Typical Operating Characteristics (continued)

(*Typical Application Circuit* with analog attenuator set to minimum attenuation ($V_{PLVLSET}$ = 2.5V), V_{CC} = 5.5V, T_C = +25°C, f_{RF_IN} = 350MHz, P_{RF_IN} = -25dBm, R_{SOURCE} = R_{LOAD} = 50Ω, CTRL1 = 0, CTRL2 = 1, ALM_THRES = ALM = open, unless otherwise noted.)

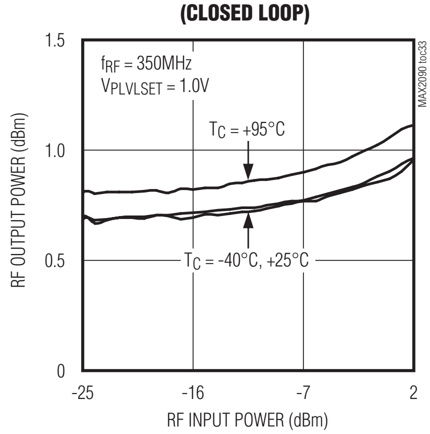
RF OUTPUT POWER vs. RF INPUT POWER (CLOSED LOOP)



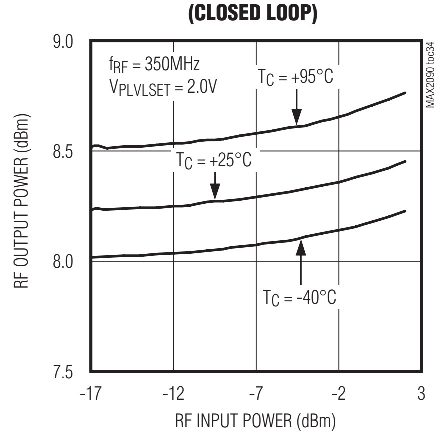
RF OUTPUT POWER vs. RF INPUT POWER (CLOSED LOOP)



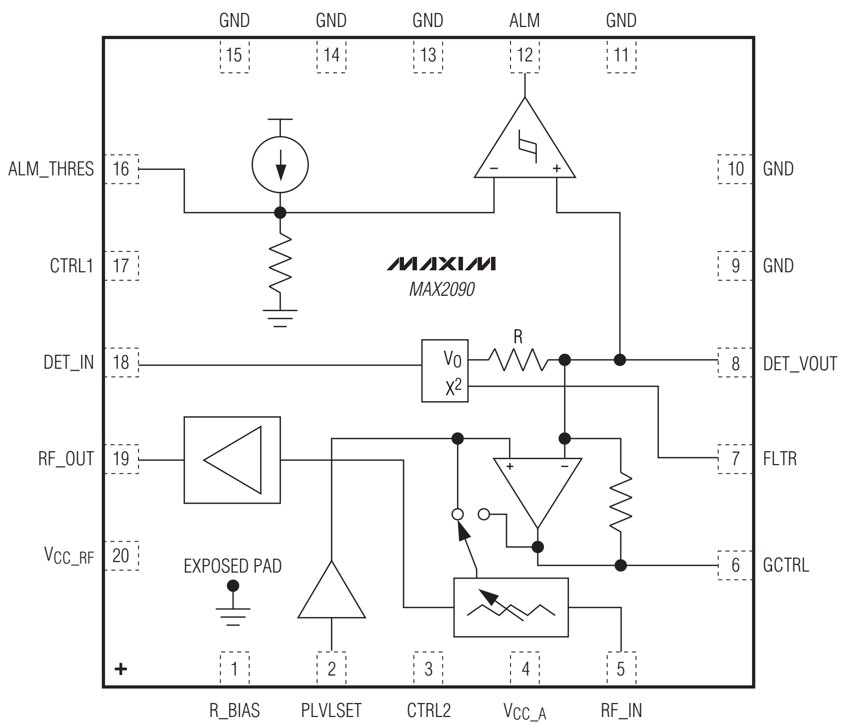
RF OUTPUT POWER vs. RF INPUT POWER (CLOSED LOOP)



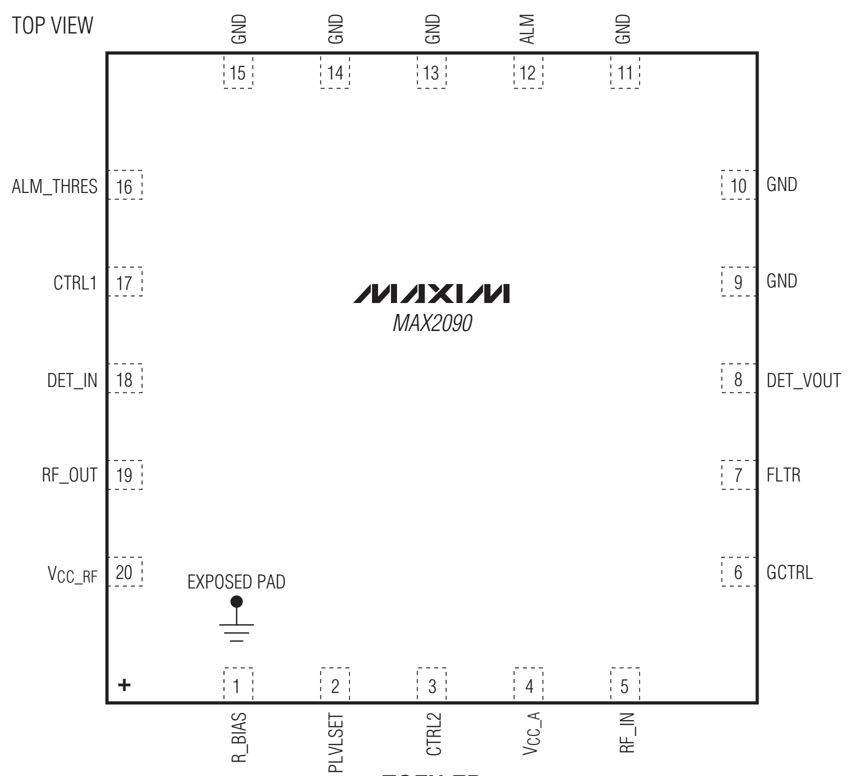
RF OUTPUT POWER vs. RF INPUT POWER (CLOSED LOOP)



Functional Block Diagram



Pin Configuration



TQFN-EP
(5mm x 5mm)

Pin Description

PIN	NAME	FUNCTION
1	R_BIAS	Bias Resistor Setting Input. Connect a resistor from this pin to ground.
2	PLVLSET	AGC Loop Threshold-Level Input/Attenuator Control
3	CTRL2	Functional Control Bit (see Table 1)
4	V_{CC_A}	Power-Supply Input. Bypass to ground with a 10nF capacitor as close as possible to the pin.
5	RF_IN	Attenuator Input (50Ω). Requires a DC-blocking capacitor.
6	GCTRL	AGC Loop Output Control Voltage/Capacitor Input
7	FLTR	Power Detector Filter Capacitor Input. Bypass to ground with a 68nF capacitor.
8	DET_VOUT	Power Detector Output Voltage
9, 10, 11, 13, 14, 15	GND	Ground

Pin Description (continued)

PIN	NAME	FUNCTION
12	ALM	Alarm Logic Output. The output is high when the RF_IN power is above the alarm threshold. The output is low when the RF_IN power is below the alarm threshold. The alarm threshold is set by the ALM_THRES pin. See the *Alarm Operation* section for details.
16	ALM_THRES	Alarm Threshold Voltage Input. See the *Alarm Operation* section for operation details.
17	CTRL1	Functional Control Bit (see Table 1)
18	DET_IN	Power Detector Input. See the *Typical Application Circuit* for connection details.
19	RF_OUT	RF Output (50Ω). See the *Typical Application Circuit* for connection details.
20	V_{CC_RF}	Driver Amplifier Supply Voltage Input. Bypass to ground with a 10nF capacitor as close as possible to the pin.
—	EP	Expose Pad. Internally connected to ground. Connect to GND for proper RF performance and enhanced thermal dissipation.

Detailed Description

The MAX2090 is a high-linearity analog VGA designed to interface with 50Ω systems operating in the 50MHz to 1000MHz frequency range. Either the on-board RMS power detector or an external analog control voltage controls the analog attenuator. The device features a gain range of -11.5dB to +25.5dB, a noise figure of 4dB, OIP3 linearity of +38dBm, and a wide RF bandwidth. Each of these features makes the device an ideal VGA for numerous receiver and transmitter applications. In addition, the device operates from a single +5.0V supply.

Applications Information

Modes of Operation

The device can operate in several different modes, as summarized in Table 1.

VGA-Only Mode Operation

VGA-only mode operation consists of setting CTRL1 = logic 1 and CTRL2 = logic 0, and applying a DC value to PLVLSET between 0 and 2.5V DC to manually adjust the attenuator and subsequently the RF_OUT power to any desired value. The output power at RF_OUT increases at a rate of 19.5dB/V as PLVLSET is increased. The power detector is powered off in this mode, reducing the supply current (10mA typ) from the case where the detector is powered on. In VGA-only mode, components R2–R5 and C6–C9 can be left unpopulated.

Closed-ALC Mode Operation

Closed-ALC mode operation consists of setting CTRL1 = CTRL2 = logic 1. The voltage on PLVLSET is set externally to 1.65V (typ), providing -3dBm at DET_IN for RF_IN power between -30dBm and +8dBm. For other input power ranges, PLVLSET can be externally driven to a DC

Table 1. Mode Control Logic

CTRL1	CTRL2	VGA	RMS DETECTOR	ALC LOOP	ALARM	FUNCTION DESCRIPTION
0	0	Disabled	Disabled	Disabled	Low	Power-down mode
0	1	Enabled	Enabled	Disabled	Enabled	Open-ALC mode: PLVLSET directly controls VGA and detector output voltage is available on DET_VOUT
1	0	Enabled	Disabled	Disabled	Low	VGA-only mode
1	1	Enabled	Enabled	Enabled	Enabled	Closed-ALC mode: ALC loop locks DET_VOUT to PLVLSET

value between 0 and 2.5V, such that the desired output power is present at DET_IN (see the *Typical Application Circuit*). As PLVLSET increases, the output power also increases at a typical rate of 17.6dB/V. The detector consists of a linear-in-dB VGA followed by an X^2 detector circuit that produces mean-square DC output on the FLTR pin. An error amplifier compares the detector's output voltage to PLVLSET and drives the attenuator in servo fashion until the error amplifier's differential input error voltage is near zero. The servo loop acts to maintain the input power level to the detector as the power level at RF_IN changes.

Open-ALC Mode Operation

Open-ALC mode operation consists of setting CTRL1 = logic 0 and CTRL2 = logic 1, and applying a DC value to PLVLSET between 0 and 2.5V DC to manually adjust the attenuator and subsequently the DET_IN power to any desired value. The output power increases at a typical rate of 19.5dB/V as PLVLSET is increased. The power detector remains powered on in this mode, and the detector output voltage is available on DET_VOUT. DET_VOUT has a typical output resistance of 235kΩ. In open-ALC mode, components R5, C8, and C9 can be left unpopulated.

Alarm Operation

During closed-loop operation and for low power levels at RF_IN, the input attenuator reaches minimum attenuation and the power level at the input of the detector falls below the desired value. ALM_THRES has 135kΩ resistance and is set internally to 1.35V (typ) such that ALM triggers when RF_IN power drops below -30dBm. Alternatively, the voltage on ALM_THRES can be externally driven to allow alternative power-level trip points. The power level at which ALM trips varies at a typical rate of 17.6dB/V of ALM_THRES. The ALM comparator has typical hysteresis of 0.5dB.

Layout Considerations

The pin configuration of the MAX2090 is optimized to facilitate a very compact physical layout of the device and its associated discrete components. The exposed pad (EP) of the device's 20-pin TQFN-EP package provides a low thermal-resistance path to the die. It is important that the PCB on which the device is mounted be designed to conduct heat from the EP. In addition, provide the EP with a low inductance path to electrical ground. The EP **MUST** be soldered to a ground plane on the PCB, either directly or through an array of plated via holes.

Table 2. Alarm Polarity

RF_IN POWER	ALM
RF_IN power > alarm threshold	1
RF_IN power < alarm threshold (low-power fault condition)	0

Table 3. Typical Application Circuit Component Values

COMPONENT	MODE OF OPERATION			VALUE	SIZE	SUPPLIER	DESCRIPTION
	VGA ONLY	CLOSED ALC	OPEN ALC				
C1, C5	√	√	√	1000pF	0402	Murata	C0G dielectric
C4				Do not install	0402	—	—
C2, C3	√	√	√	0.01µF	0402	Murata	X7R dielectric
C6		√	√	68nF	0603	Murata	X7R dielectric
C7		√	√	1000pF	0402	Murata	C0G dielectric
C8		√		100nF	0603	Murata	X7R dielectric
C9		√		820pF	0402	Murata	C0G dielectric
C14*				Do not install	0402	—	—

Table 3. Typical Application Circuit Component Values (continued)

COMPONENT	MODE OF OPERATION			VALUE	SIZE	SUPPLIER	DESCRIPTION
	VGA ONLY	CLOSED ALC	OPEN ALC				
C16		√	√	0.01µF	0402	Murata	X7R dielectric
L1	√	√	√	330nH	0603	Coilcraft	Ferrite LS series 5% tolerance
R1	√	√	√	1.78kΩ	0402	Panasonic	1% tolerance
R2, R3		√	√	84.5Ω	0402	Panasonic	1% tolerance
R4		√	√	1.43kΩ	0402	Panasonic	1% tolerance
R5		√		150Ω	0402	Panasonic	1% tolerance
R11*	√	√	√	0Ω	0402	Panasonic	1% tolerance
U1	√	√	√	—	20-pin TQFN (5mm x 5mm)	Maxim	MAX2090ETP+

Note: *The checkmarks in the* Mode of Operation *columns indicate that the component is used within each respective application.*
**C14 and R11 form an optional lowpass network to filter out potential noise from the the external PLVLSET control source.*

Chip Information

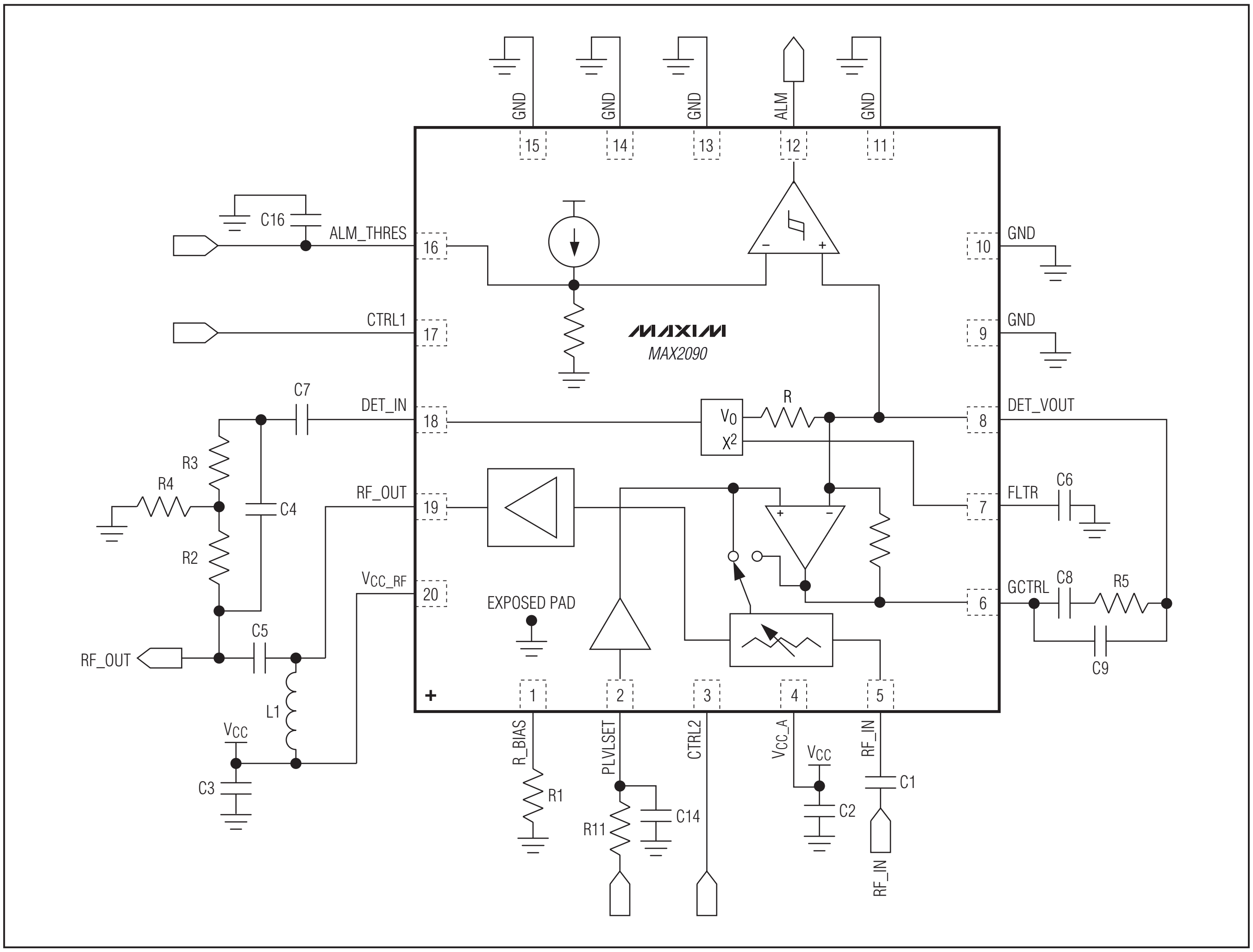
PROCESS: SiGe BiCMOS

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX2090ETP+	-40°C to +95°C	20 TQFN-EP*
MAX2090ETP+T	-40°C to +95°C	20 TQFN-EP*

+Denotes a lead(Pb)-free/RoHS-compliant package.
**EP = Exposed pad.*
T = Tape and reel.

Typical Application Circuit



Package Information

For the latest package outline information and land patterns (footprints), go to **www.maxim-ic.com/packages**. Note that a “+”, “#”, or “-” in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

PACKAGE TYPE	PACKAGE CODE	OUTLINE NO.	LAND PATTERN NO.
20 TQFN-EP	T2055+5	21-0140	90-0010

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	9/11	Initial release	—