

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC2782GR

L BAND DOWN CONVERTER IC

DESCRIPTION

The μ PC2782GR is a Silicon monolithic IC designed for use as L band downconverter. This IC consists of a Gilbert cell mixer, two stages of LO buffering, local oscillator, external filter port, or a high output IF AGC amplifier and IF output buffer amplifier.

The package is 20 pins SSOP (shrink small outline package) suitable for high-density surface mount.

FEATURES

- Broad band operation $f_{RF} = 0.9$ to 2.1 GHz
- 25 dB variable gain IF AGC amplifier
- Low distortion $IIP_3 = +4.5$ dBm ($f_{RF} = 2.1$ GHz)
- Supply Voltage 5 V
- Packaged in 20 pins SSOP suitable for high-density surface mount

ORDERING INFORMATION

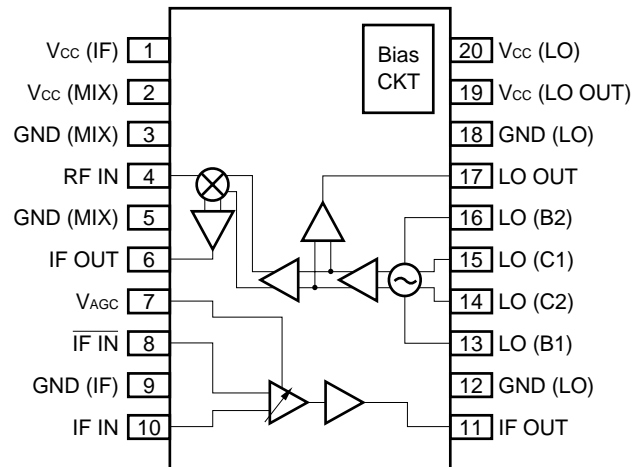
Part Number	Package	Package Style
μ PC2782GR-E1	20 pin plastic SSOP (225 mil)	Embossed tape 12 mm wide. 2.5 k/REEL. Pin 1 indicates pull-out direction of tape

For evaluation sample order, please contact your local NEC sales office. (Part number for sample order: μ PC2782GR)

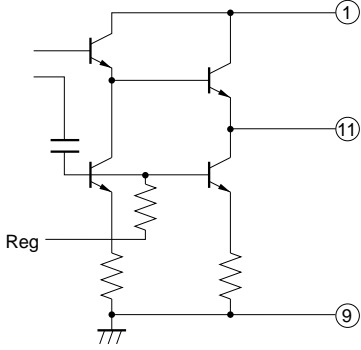
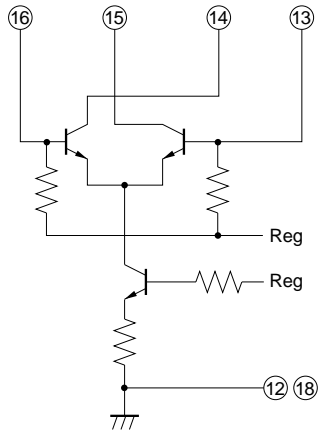
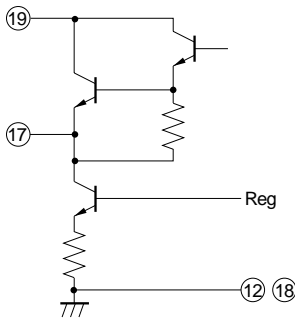
Caution electro-static sensitive devices.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

INTERNAL BLOCK DIAGRAM



Pin No.	Symbol	Pin Volt TYP.(V)	Functions and Explanation	Equivalent Circuit
1	V _{cc} (IF)	5.00	Power supply pin of IF AGC Amp.	
2	V _{cc} (MIX)	5.00	Power supply pin of Mixer	
3	GND (MIX)	0.00	Ground pin of Mixer.	
4	RF IN	2.00	RF signal input pin.	
5	GND (MIX)	0.00	Ground pin of Mixer.	
6	IF OUT	1.85	Output pin of Mixer. This pin is assigned for the emitter follower output.	
7	V _{AGC}	0 to 5	Gain control pin. This pin's bias govern the AGC output level. Maximum gain at V _{AGC} = 0 V Minimum gain at V _{AGC} = 5 V	
8	$\overline{\text{IF IN}}$	2.36	IF signal input pin of IF AGC Amp. In case of single input, this pin should be grounded through 1 000 pF capacitor.	
9	GND (IF)	0.00	Ground pin of IF AGC Amp.	
10	IF IN	2.36	IF signal input pin of IF AGC Amp.	

Pin No.	Symbol	Pin Volt TYP.(V)	Functions and Explanation	Equivalent Circuit
11	IF OUT	2.55	Output pin of IF AGC Amp. This pin is assigned for emitter follower push-pull output.	
12	GND (LO)	0.00	Ground pin of Oscillator amplifier, Buffer amplifier, Oscillator output.	
13	LO (B1)	2.30	Base pin of oscillator. Connected to 14 pin through capacitor.	
14	LO (C2)	5.00	Collector pin of oscillator. Connected to 15 pin through capacitor. Oscillator frequency bandwidth is depended on this capacitor. This pin should be connected to Vcc through 150 Ω resistor.	
15	LO (C1)	5.00	Collector pin of oscillator. Connected to 14 pin through capacitor. This pin should be connected to Vcc through 150 Ω resistor.	
16	LO (B2)	2.30	Base pin of oscillator. Connected to 15 pin through capacitor. Assemble LC resonator between 13 pin and 16 pin through 2 pF capacitor to oscillate.	
17	LO OUT	3.15	Output pin of Oscillator. This pin is assigned for emitter follower output.	
18	GND (LO)	0.00	Ground pin of Oscillator amplifier, Buffer amplifier, Oscillator output.	
19	VCC (LO)	5.00	Power supply pin of Oscillator output.	
20	VCC (LO)	5.00	Power supply pin of Oscillator amplifier, Buffer amplifier.	

Absolute Maximum Ratings (TA = 25 °C unless otherwise specified)

Parameter	Symbol	Test Conditions	Rating	Unit
Supply Voltage	V _{CC}		6.0	V
Power dissipation	P _D	T _A = 85 °C ^{*1}	430	mW
Operation temperature range	T _A		-40 to +85	°C
Storage temperature range	T _{stg}		-55 to +150	°C

*1 Mounted on 50 × 50 × 1.6 mm double copper epoxy glass board.

Recommended Operating Range

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V _{CC}	4.5	5.0	5.5	V
Operating temperature range	T _A	-40	+25	+85	°C

Electrical Characteristics (T_A = 25 °C, V_{CC} = 5 V)

Parameter	Symbol	MIN.	TYP.	MAX.	UNIT	Test Conditions
Circuit Current	I _{CC}	46	66	78	mA	No input signal *2
RF Input Frequency Range	RF BW	0.9		2.1	GHz	P _{RF} = -20 dBm, P _{OSC} = -10 dBm f _{IF} = 480 MHz, -3 dB down *2
IF Output Frequency Range	IF BW	150		500	MHz	f _{RF} = 2.1 GHz, P _{RF} = -20 dBm P _{OSC} = -10 dBm, -3 dB down *2
Mixer Section						
Conversion Gain	CG1	7	10	13	dB	f _{RF} = 900 MHz, P _{RF} = -30 dBm f _{OSC} = 1 380 MHz, P _{OSC} = -10 dBm *2
Conversion Gain 2	CG2	8	11	14	dB	f _{RF} = 2.1 GHz, P _{RF} = -30 dBm f _{OSC} = 2.58 GHz, P _{OSC} = -10 dBm *2
Maximum Output Power 1	P _{O (sat)1}	+2	+5	-	dBm	f _{RF} = 900 MHz, P _{RF} = 0 dBm f _{OSC} = 1 380 MHz, P _{OSC} = -10 dBm *2
Maximum Output Power 2	P _{O (sat)2}	+2	+5	-	dBm	f _{RF} = 2.1 GHz, P _{RF} = 0 dBm f _{OSC} = 2.58 GHz, P _{OSC} = -10 dBm *2
Noise Figure 1	NF1	-	11.0	14.0	dB	f _{RF} = 900 MHz, P _{OSC} = -10 dBm *3
Noise Figure 2	NF2	-	13.5	16.5	dB	f _{RF} = 2.1 GHz, P _{OSC} = -10 dBm *3
IF Amp. Section						
IF Input Frequency Range	IFinBW	150	-	500	MHz	P _{IF} = -30 dBm, V _{AGC} = 0 V -3 dB down *4
IF Power Gain	G _{IF}	20	23	26	dB	f _{IF} = 480 MHz, P _{IF} = -30 dBm V _{AGC} = 0 *4
Maximum Output Power 3	P _{O (sat)3}	+5	+8	-	dBm	f _{IF} = 480 MHz, P _{IF} = 0 dBm V _{AGC} = 0 V *4
AGC Dynamic range	ΔG _{AGC}	20	25	-	dB	f _{IF} = 480 MHz, P _{IF} = -30 dBm V _{AGC} = 0 to 5 V *4
Noise Figure 3	NF3	-	12.0	15.0	dB	f _{IF} = 480 MHz, V _{AGC} = 0 V *5

*2 by measurement circuit 1

*3 by measurement circuit 2

*4 by measurement circuit 4

*5 by measurement circuit 5

Standard Characteristics (T_A = 25 °C, V_{CC} = 5 V)

Parameter	Symbol	Reference Value			UNIT	Test Conditions
		MIN.	TYP.	MAX.		
Mixer Section						
Input Intercept Point 1	IIP ₃₁	–	0	–	dBm	f _{RF} = 900, 930 MHz, f _{OSC} = 1 380 MHz P _{OSC} = –10 dBm *6
Input Intercept Point 2	IIP ₃₂	–	+4.5	–	dBm	f _{RF} = 2.1, 2.13 GHz, f _{OSC} = 2.58 GHz P _{OSC} = –10 dBm *6
Third Intermodulation Distortion 1	IM ₃₁	–	50	–	dBc	f _{RF} = 900, 930 MHz, P _{RF} = –25 dBm each f _{OSC} = 1 380 MHz, P _{OSC} = –10 dBm *6
Third Intermodulation Distortion 2	IM ₃₂	–	59	–	dBc	f _{RF} = 2.1, 1.13 GHz, P _{RF} = –25 dBm each f _{OSC} = 2.58 GHz, P _{OSC} = –10 dBm *6
Oscillator Output Power	P _{OSC}	–	–15	–	dBm	*7
Oscillator Frequency Range	f _{OSC}	1.3	–	2.6	GHz	*7
IF Amp. Section						
Output Intercept Point	OIP ₃	–	+15.5	–	dBm	f _{IF} = 480, 510 MHz *8

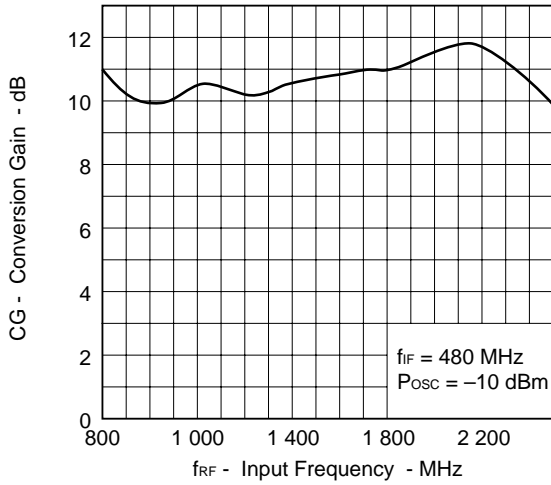
*6 by measurement circuit 3

*7 by application circuit example

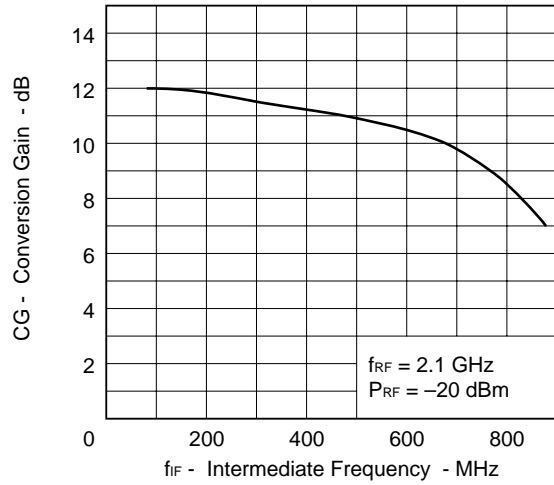
*8 by measurement circuit 6

Typical Characteristics ($V_{CC} = 5\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$)

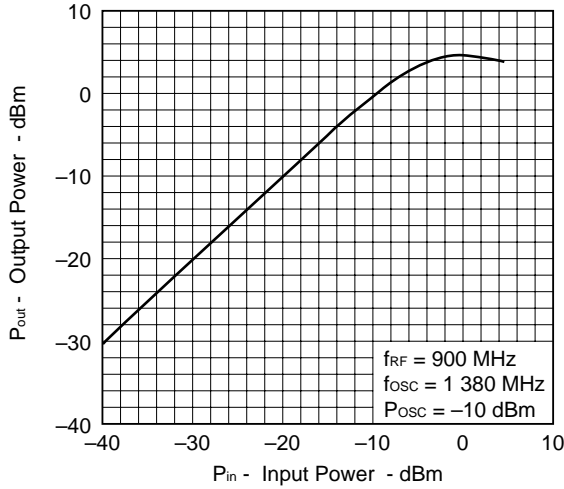
f_{RF} vs. CG (MIXER)



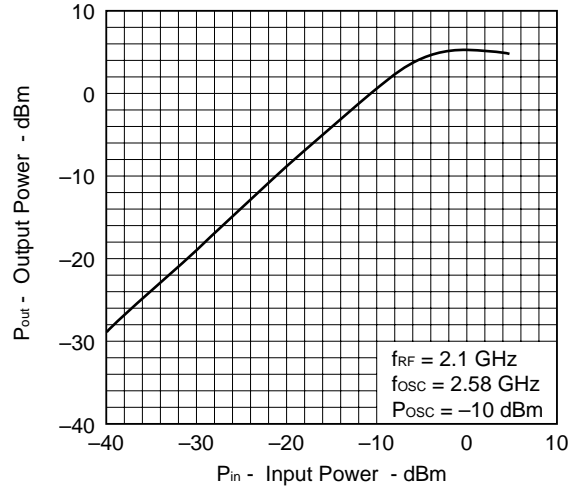
f_{IF} vs. CG (MIXER)



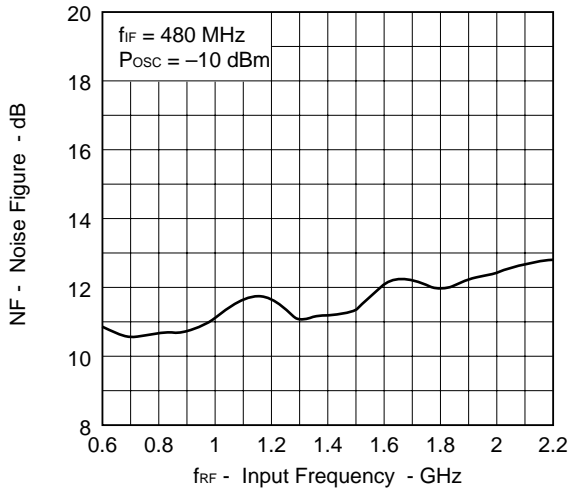
P_{in} vs. P_{out} (MIXER)



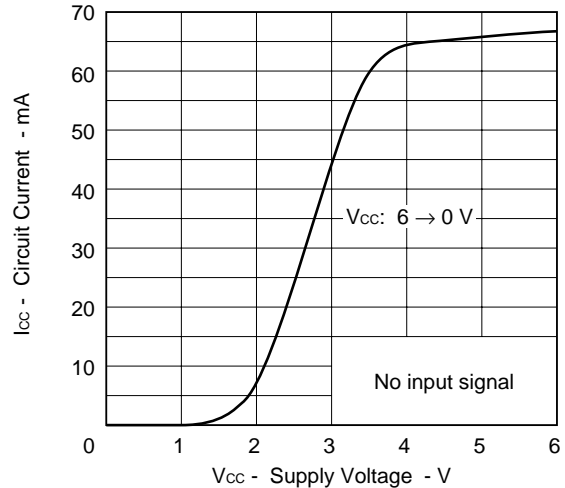
P_{in} vs. P_{out} (MIXER)

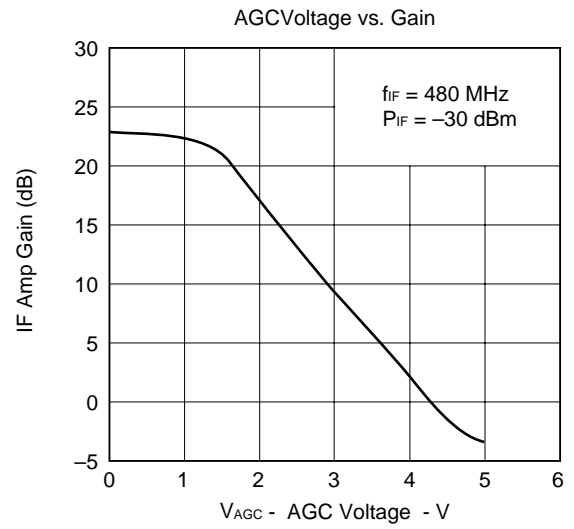
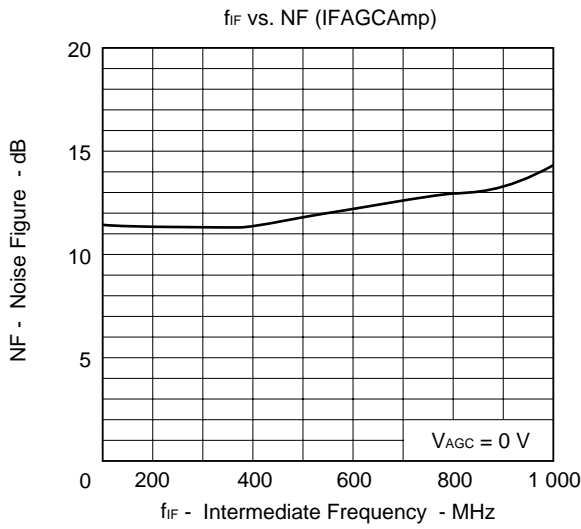
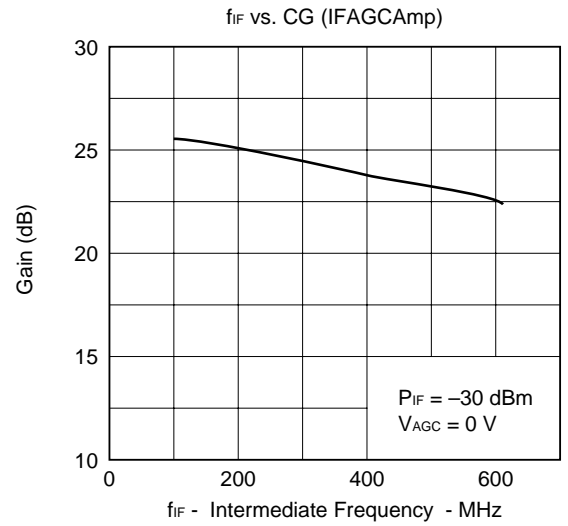
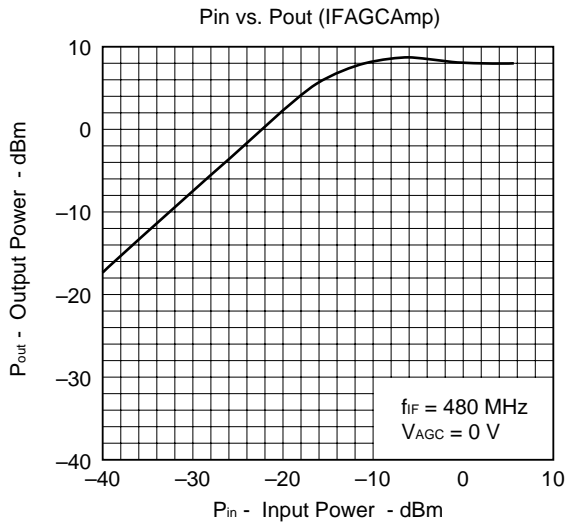


f_{RF} vs. NF (MIXER)



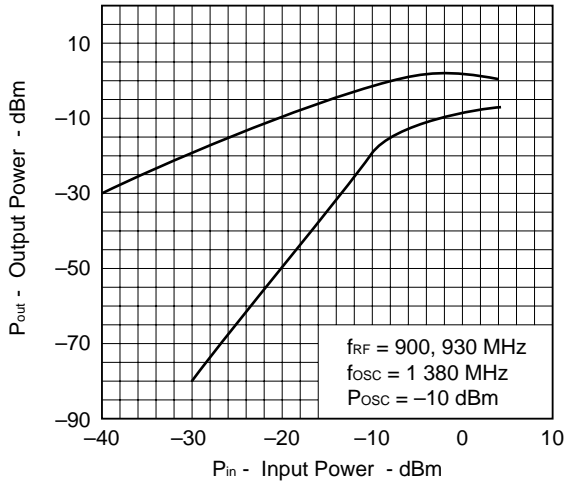
V_{CC} vs. I_{CC}



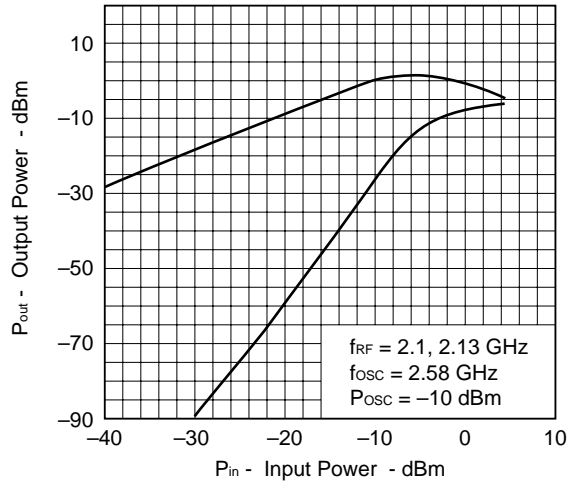


Standard Characteristics ($V_{CC} = 5\text{ V}$, $T_A = 25\text{ }^\circ\text{C}$)

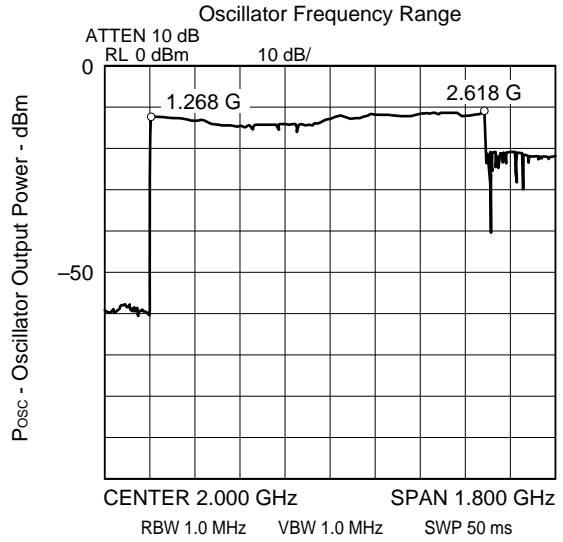
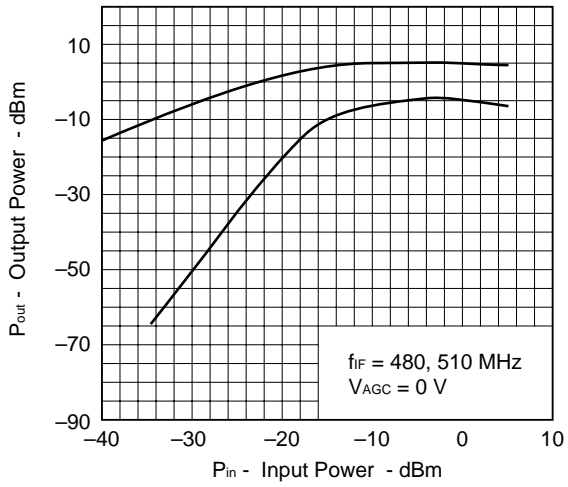
IM₃ (MIXER)



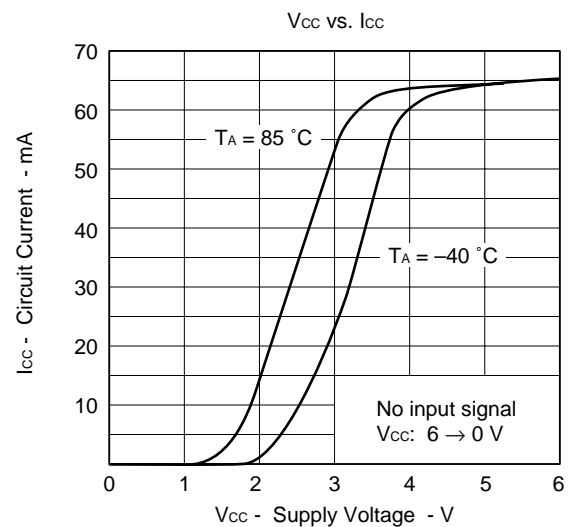
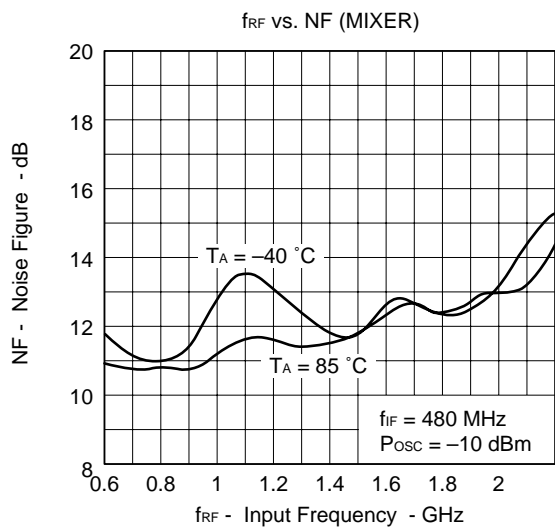
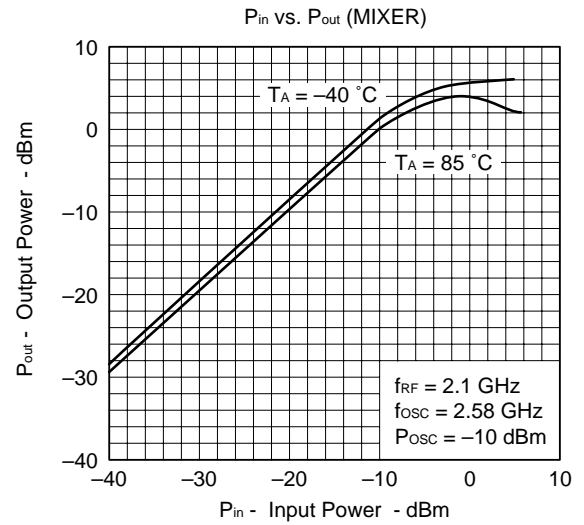
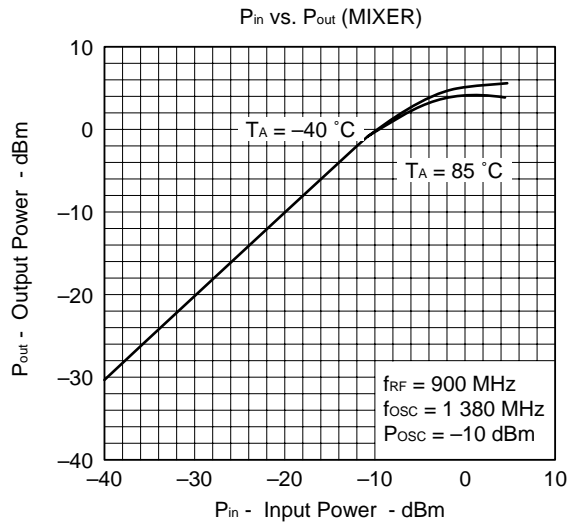
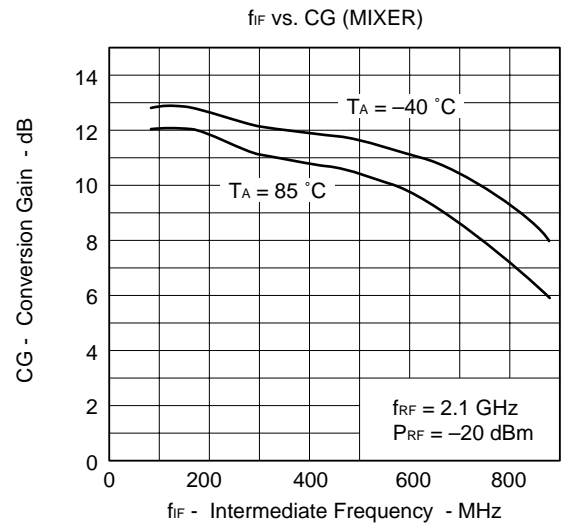
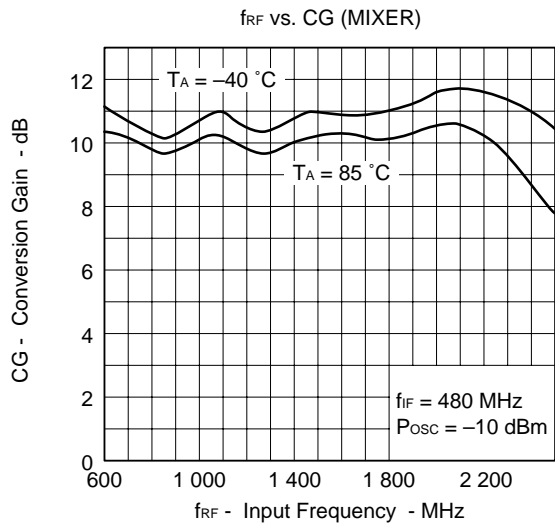
IM₃ (MIXER)

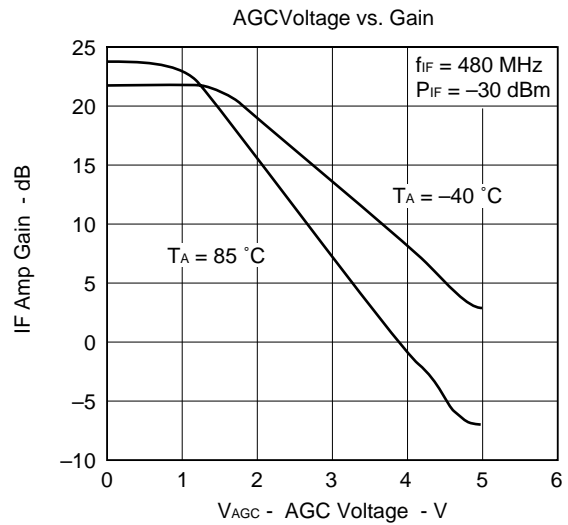
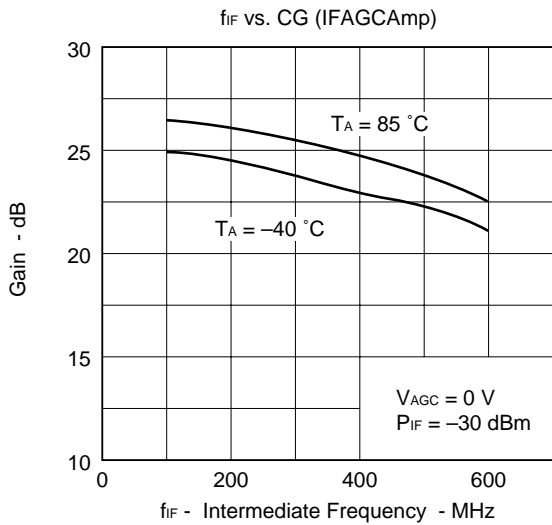
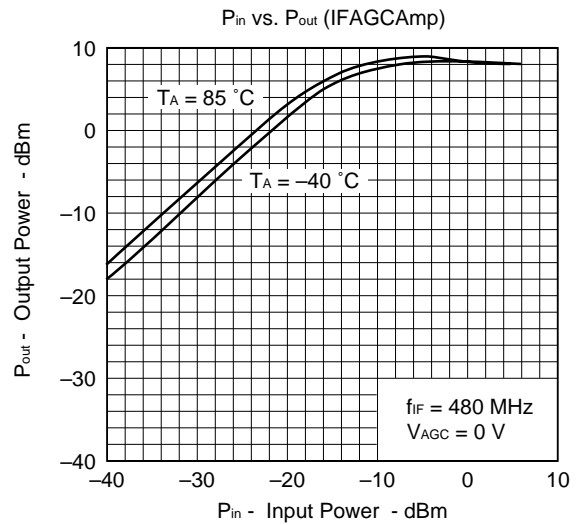
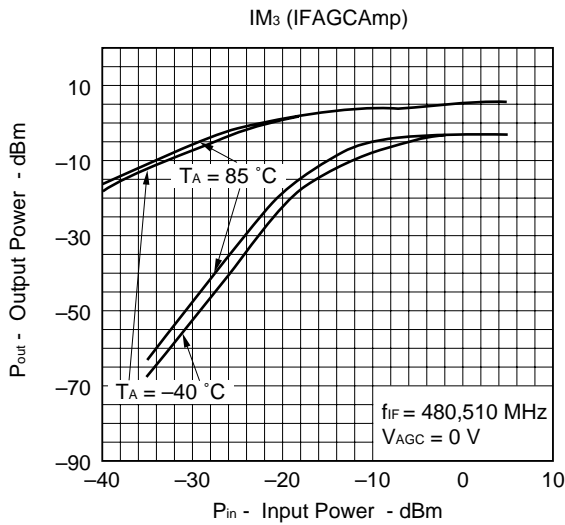
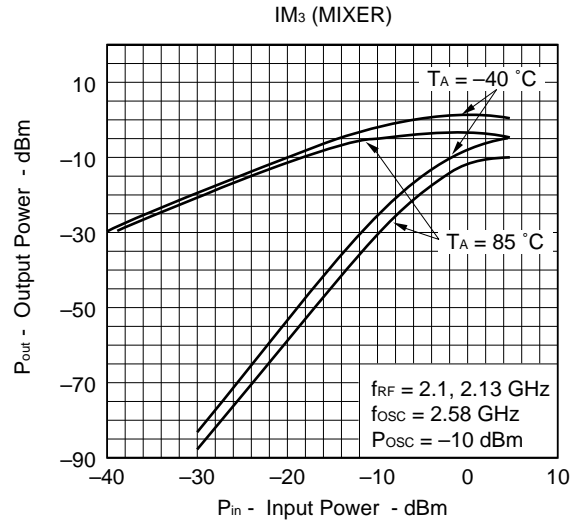
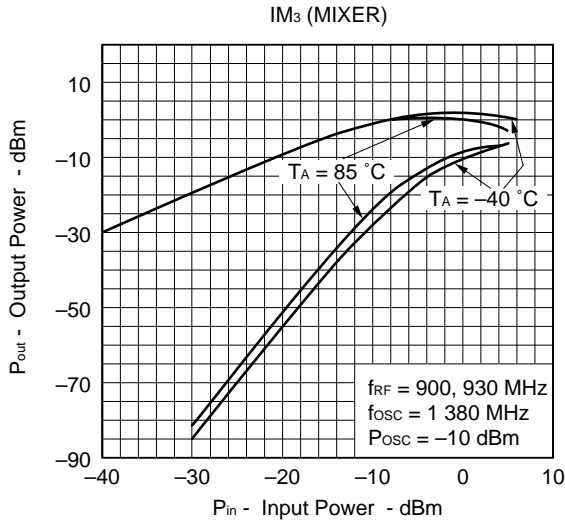


IM₃ (IFAGCAmp)

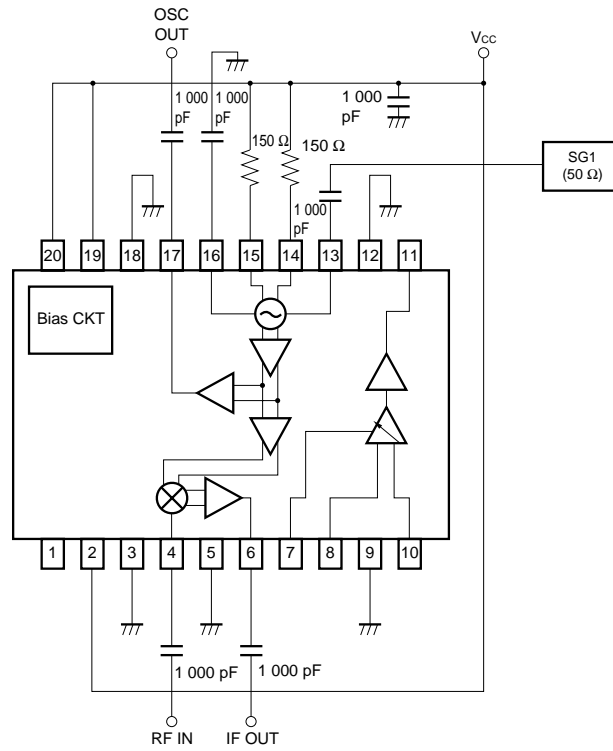


Standard Characteristics ($V_{CC} = 5\text{ V}$, $T_A = -40\text{ }^\circ\text{C}$, $85\text{ }^\circ\text{C}$)

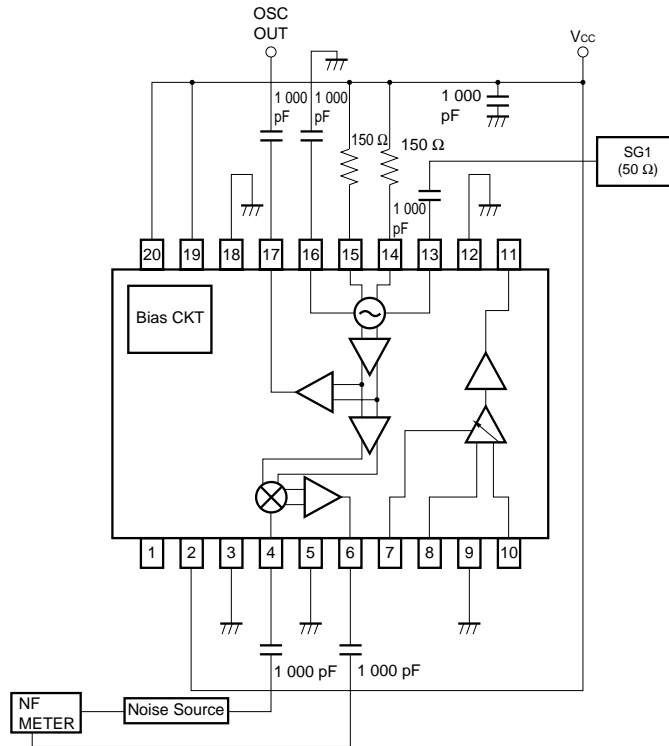




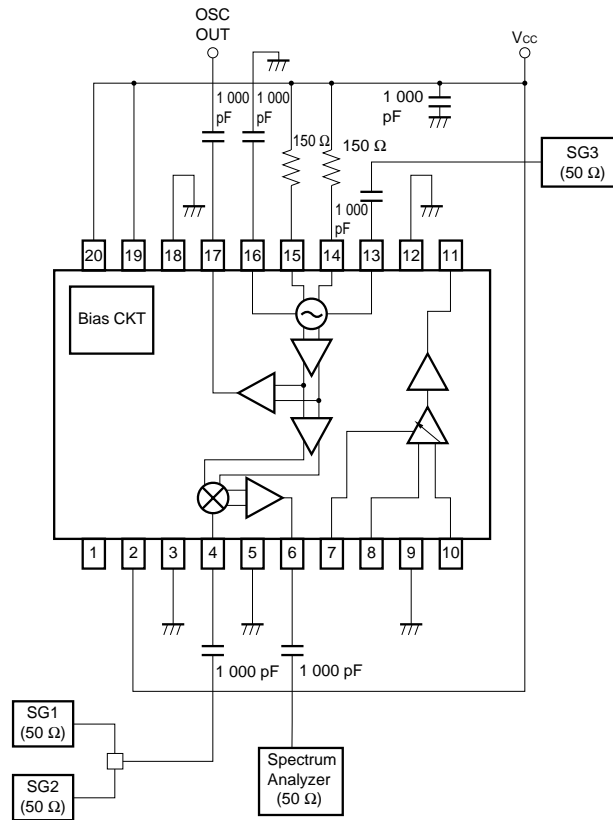
Measurement Circuit 1



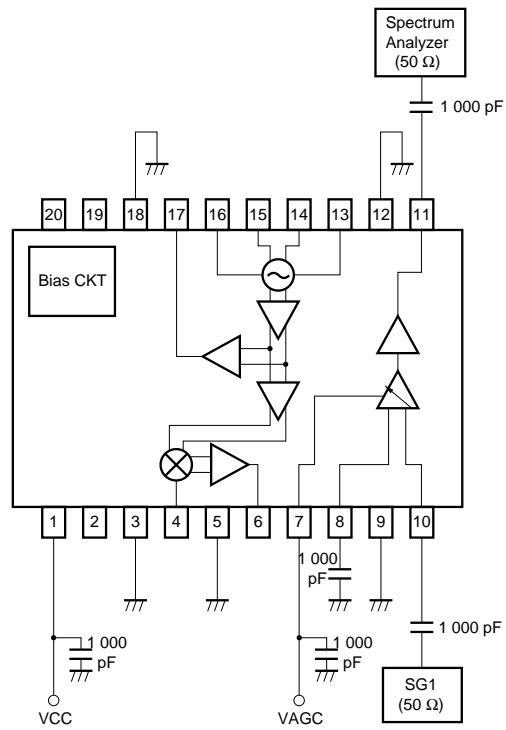
Measurement Circuit 2



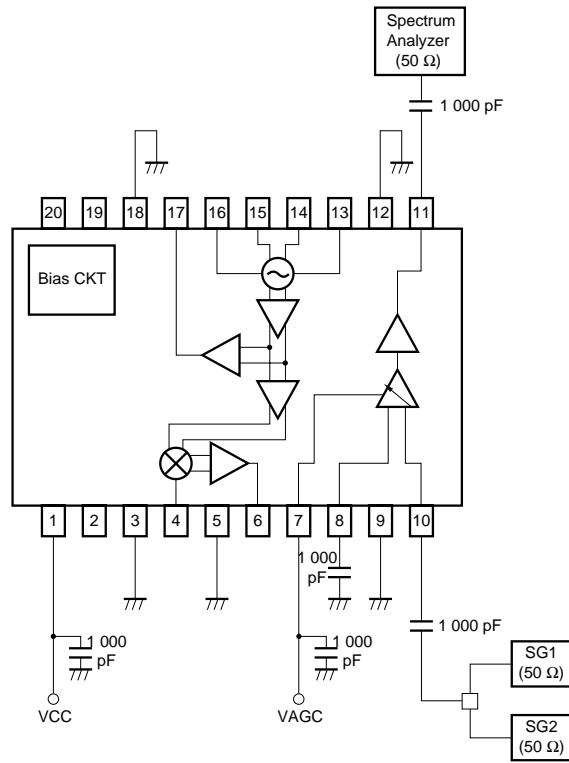
Measurement Circuit 3



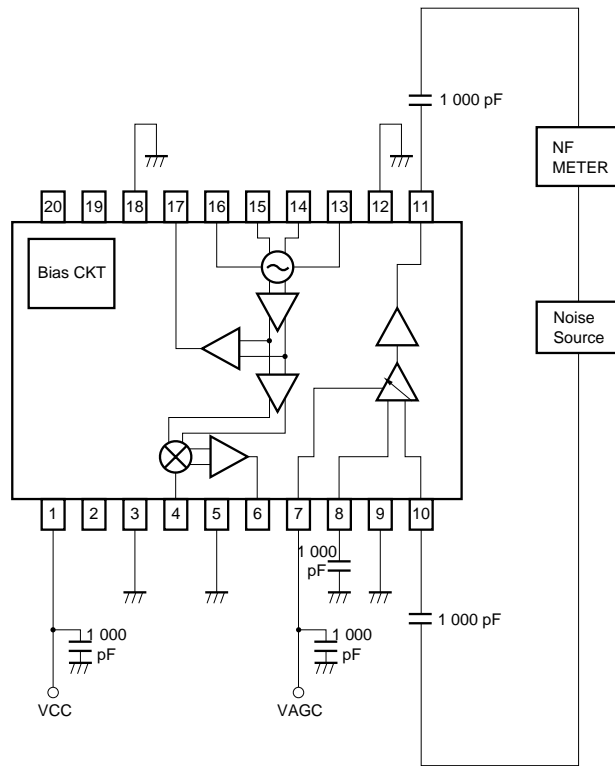
Measurement Circuit 4



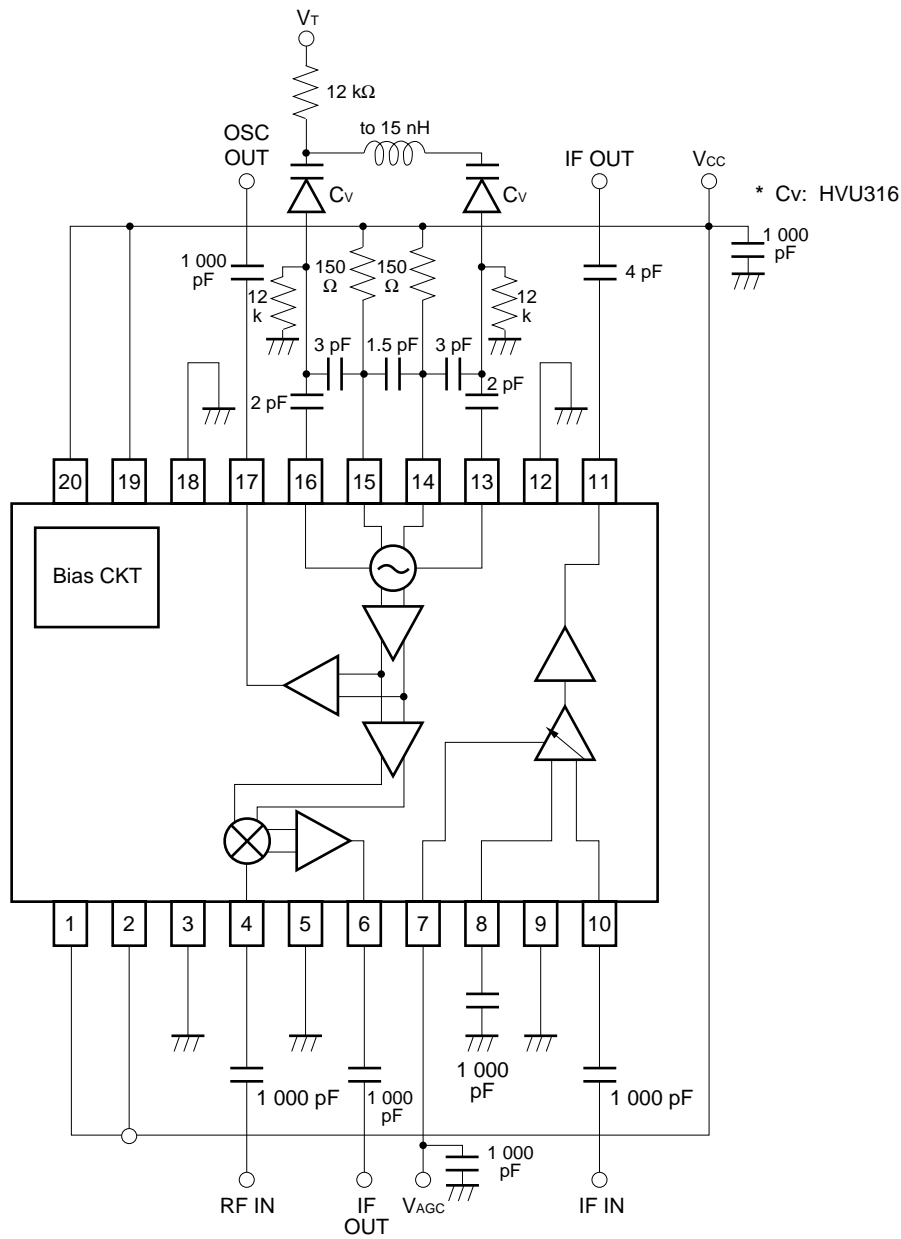
Measurement Circuit 5



Measurement Circuit 6

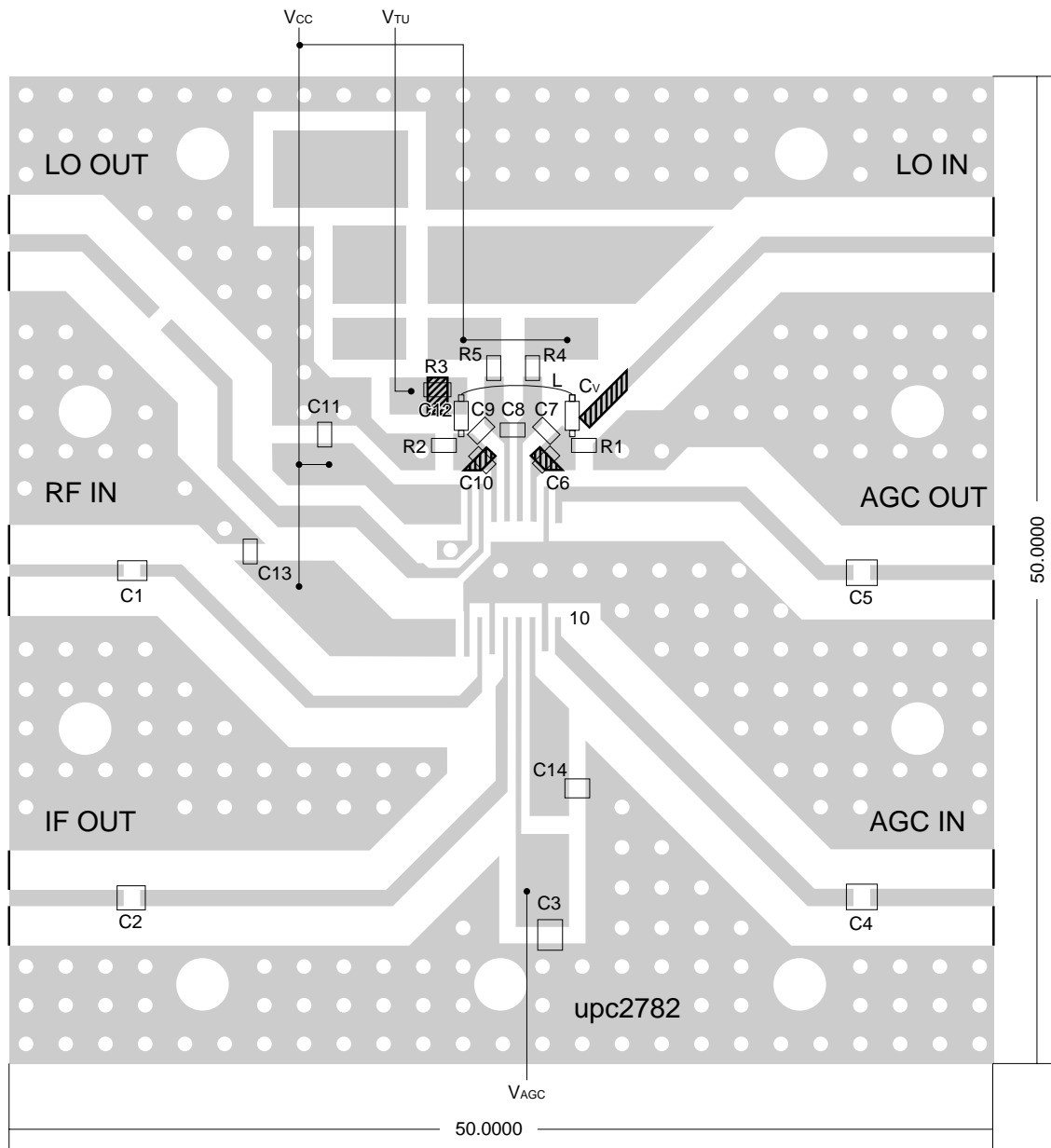


Application Circuit Example

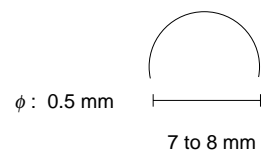


The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

Illustration of The Application Circuit Assembled on Evaluation Board



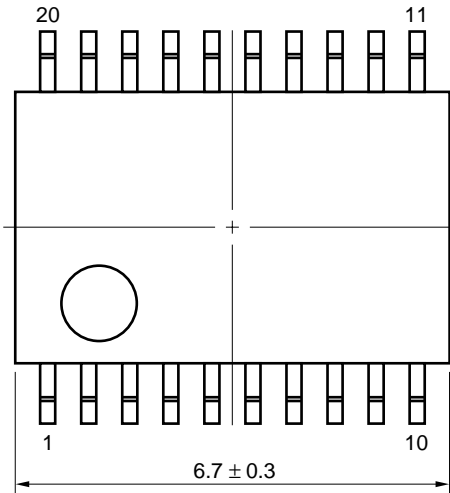
- C1 to C5 : 1 000 pF
- C6, C10 : 2 pF
- C7, C9 : 3 pF
- C8 : 1.5 pF
- C11 to C14 : 1 000 pF
- R1 to R3 : 12 k Ω
- R4, R5 : 150 Ω
- Cv : HVU316
- L : to 15 nH



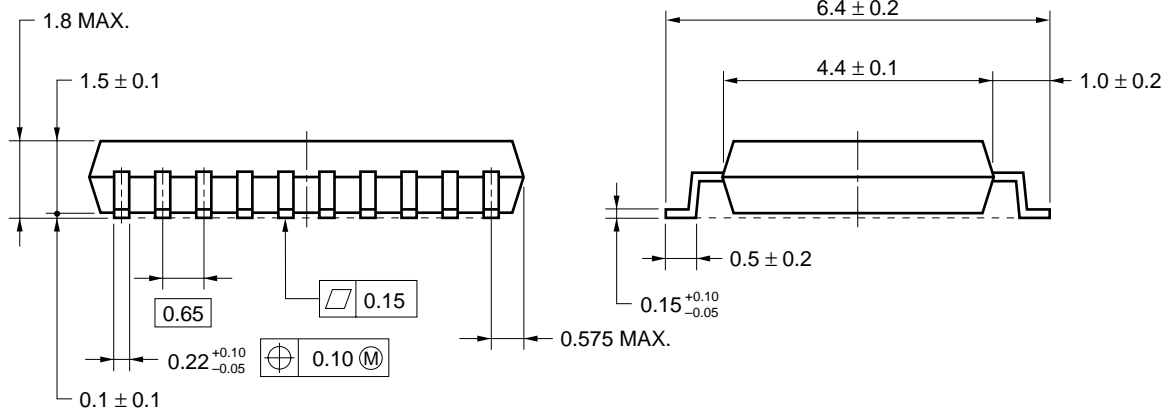
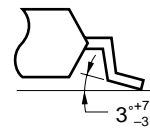
* pattern should be removed on this application

PACKAGE DIMENSIONS

★ 20 PIN PLASTIC SSOP (225 mil) (UNIT: mm)



detail of lead end



NOTE Each lead centerline is located within 0.10 mm of its true position (T.P.) at maximum material condition.

Recommended Soldering Conditions

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales officers in case other soldering process is used or in case soldering is done under different conditions.

For details of recommended soldering conditions for surface mounting, refer to information document SEMI CONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E).

μPC2782GR

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 235 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 3, Exposure limit ^{Note} : None	IR35-00-3
VPS	Peak package's surface temperature: 215 °C or below, Reflow time: 40 seconds or below (200 °C or higher), Number of reflow process: 3, Exposure limit ^{Note} : None	VP15-00-3
Wave soldering	Solder temperature: 260 °C or below, Reflow time: 10 seconds or below, Number of reflow process: 1, Exposure limit ^{Note} : None	WS60-00-1
Partial heating method	Terminal temperature: 300 °C or below, Flow time: 3 seconds or below, Exposure limit ^{Note} : None	

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Caution Do not apply more than single process at once, except for “Partial heating method”.

NESAT (NEC Silicon Advanced Technology) is a trademark of NEC Corporation.

- **The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.**
 - No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.
 - NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.
 - Descriptions of circuits, software, and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software, and information in the design of the customer's equipment shall be done under the full responsibility of the customer. NEC Corporation assumes no responsibility for any losses incurred by the customer or third parties arising from the use of these circuits, software, and information.
 - While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.
 - NEC devices are classified into the following three quality grades:
"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.
 - Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
 - Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
 - Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.
- The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.