NEC

SILICON MMIC L/S BAND DOWNCONVERTER

UPC2782GR

FEATURES

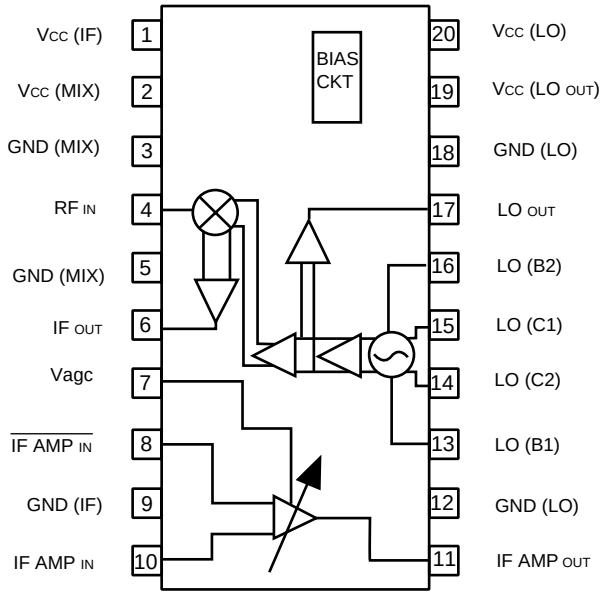
- **WIDEBAND OPERATION:** 900 - 2100 MHz
- **HIGH DYNAMIC RANGE:** +4.5 dBm IIP_3
- **HIGH LO-RF ISOLATION:** -40 dBm Leakage
- **VARIABLE GAIN IF AMP:** 25 dB Control Range
- **INTERNAL LO**
- **SMALL 20 PIN SSOP PACKAGE**
- **TAPE AND REEL PACKAGING OPTION AVAILABLE**

DESCRIPTION

The UPC2782GR is a Silicon Monolithic Microwave Integrated Circuit manufactured using the NESAT III process. This process produces transistors with f_T of 20 GHz. This device consists of a Gilbert cell mixer, two stages of LO buffering, local oscillator, external filter port, a high output variable gain IF amp, and a temperature compensation circuit. The device was specifically designed for digital satellite receivers, WLAN's, and other digital receiver applications.

NEC's stringent quality assurance and test procedures assure the highest reliability and performance.

INTERNAL BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS (T_A = 25°C, Vcc = 5V, P_{LO} = -10 dBm, Z_L = Z_S = 50 Ω unless otherwise specified)

	PART NUMBER PACKAGE OUTLINE			UPC2782GR S20		
	SYMBOLS	**PARAMETERS AND CONDITIONS**	**UNITS**	**MIN**	**TYP**	**MAX**
	I_{CC}	Circuit Current	mA	46	66	78
	f_{RFin}	RF Frequency Response, P_{RFin} = -20dBm, f_{IF} = 480 MHz, -3 dB down	GHz	0.9		2.1
	f_{IFout}	IF Frequency Response, P_{RFin} = -20 dBm, f_{RF} = 2.1 GHz, -3 dB down	MHz	150		500
Mixer Section	CG	Conversion Gain[1], f_{RF} = 900 MHz, f_{LO}= 1380 MHz f_{RF} = 2.1 GHz, f_{LO} = 2.58 GHz	dB dB	7 8	10 11	13 14
	P_{SAT}	Saturated Output Power[2], f_{RF} = 900 MHz, f_{LO} = 1380 MHz f_{RF} = 2.1 GHz, f_{LO} = 2.58 GHz	dBm dBm	+2 +2	+5 +5	
	NF	Noise Figure, f_{RF} = 900 MHz f_{RF} = 2.1 GHz	dB dB		11 13.5	14 16.5
	IIP_3	Input 3rd Order Intercept Point, f_{RF} = 900, 930 MHz, f_{LO} = 1380 MHz f_{RF} = 2.1, 2.13 GHz, f_{LO} = 2.58 GHz	dBm dBm		0 +4.5	
	IM_3	Two-Tone 3rd Order Intermod Level, f_{RF} = 900, 930 MHz, P_{RF} = -25 dBm each, f_{LO} = 1380 MHz f_{RF} = 2.1, 2.13 GHz, P_{RF} = -25 dBm each, f_{LO} = 2.58 GHz	 dBc dBc		 50 59	
	P_{LOout}	Internal LO Output Power (pin 17), f_{LO} = 1.9 GHz	dBm		-15	
	LO_{LRF}	LO Leakage to RF Pin, f_{LO} = 1.0 ~ 2.6 GHz	dBm		-40	
	LO_{LIF}	LO Leakage to IF Pin, f_{LO} = 1.0 ~ 2.6 GHz	dBm		-20	
	PN	SSB Phase Noise, 10 KHz Offset	dBc/Hz		-75	
	f_{OSC}	Oscillator Frequency Range	GHz	1.3		2.6

ELECTRICAL CHARACTERISTICS (con't) (T_A = 25°C, Vcc = 5V, P_{LO} = -10 dBm, Z_L = Z_S = 50 Ω unless otherwise specified)

	PART NUMBER PACKAGE OUTLINE			UPC2782GR S20		
	SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
IF AGC Section	G_{IF}	Gain, f_{IF} = 480 MHz, P_{IF} = - 30 dBm, V_{AGC} = 0 V	dB	20	23	26
	$P_{SAT, IF}$	Saturated Output Power, f_{IF} = 480 MHz, P_{IF}= 0 dBm, V_{AGC} = 0 V	dBm	+5	+8	
	ΔG_{AGC}	Gain Control Range, f_{IF} = 480 MHz, P_{IF} = -30 dBm, V_{AGC} = 0~5 V	dB	20	25	
	NF_{IF}	Noise Figure, f_{IF} = 480 MHz, V_{AGC} = 0 V	dB		12	15
	RL_{IFin}	IF Input Return Loss	dB		12	
	RL_{IFout}	IF Output Return Loss	dB		12	
	OIP_3	IF Output 3rd Order Intercept Point, f_{IF} = 480, 510 MHz, P_{OUT} = -5 dBm, V_{AGC} = 0 V	dBm		+15.5	

Notes:
1. P_{RFin} = -30 dBm
2. P_{RFin} = 0 dBm

ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V_{CC}	Supply Voltage	V	6.0
P_D	Power Dissipation[2]	mW	430
T_{OP}	Operating Temperature	°C	-40 to +85
T_{STG}	Storage Temperature	°C	-55 to +150

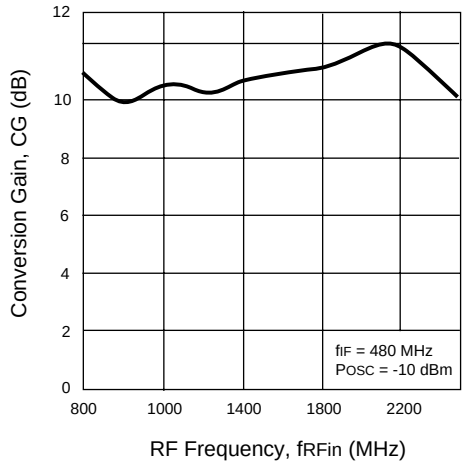
Notes:
1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB (T_A = +85°C).

RECOMMENDED OPERATING CONDITIONS

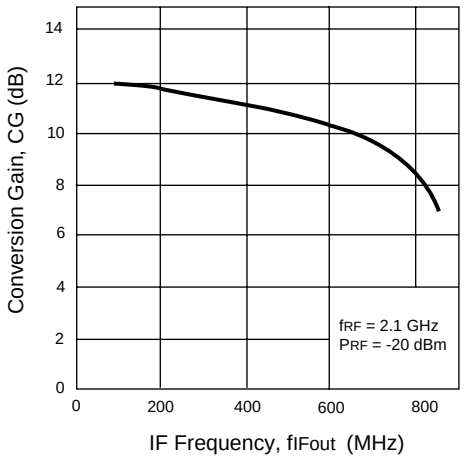
SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V_{CC}	Supply Voltage	V	4.5	5.0	5.5
T_{OP}	Operating Temperature	°C	-40	+25	+85
P_{LOin}	LO Input Level	dBm	-15	-10	0
f_{RFin}	RF Input Frequency	GHz	0.9		2.5
f_{IFout}	IF Output Frequency	MHz	150		500

TYPICAL PERFORMANCE CURVES (T_A = 25°C, V_{CC} = 5 V)

CONVERSION GAIN vs. RF FREQUENCY

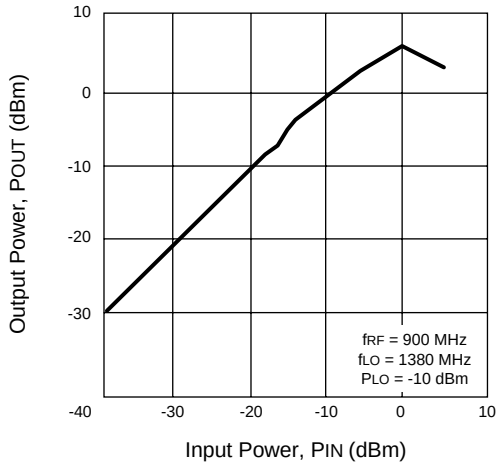


CONVERSION GAIN vs. IF FREQUENCY

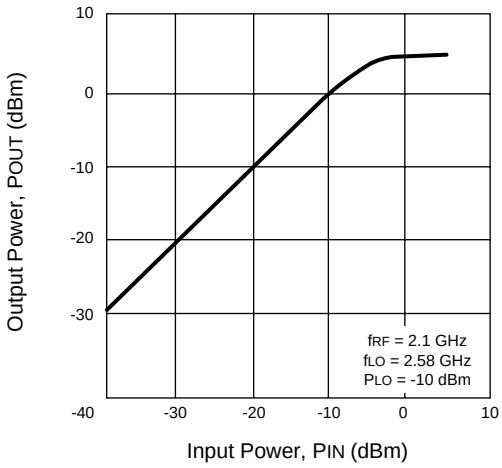


TYPICAL PERFORMANCE CURVES (TA = 25°C, VCC = 5 V)

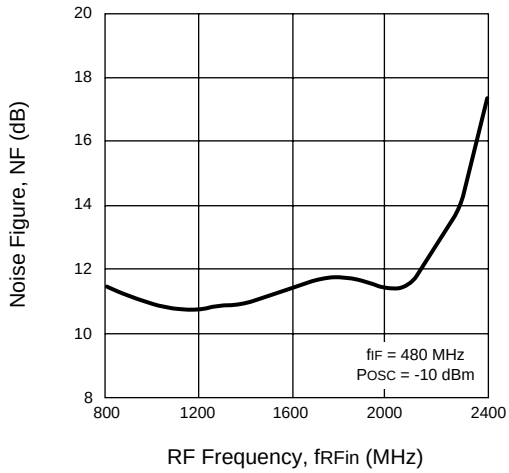
OUTPUT POWER vs. INPUT POWER (MIXER)



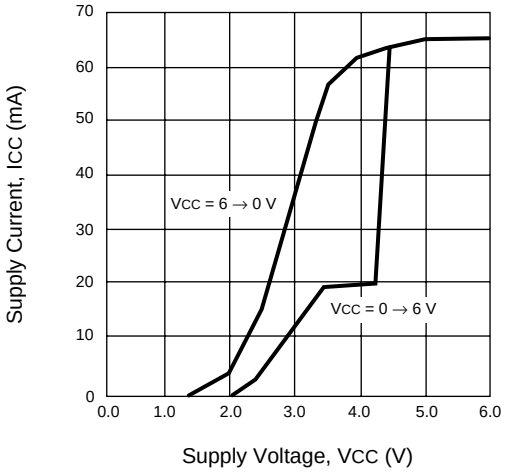
OUTPUT POWER vs. INPUT POWER (MIXER)



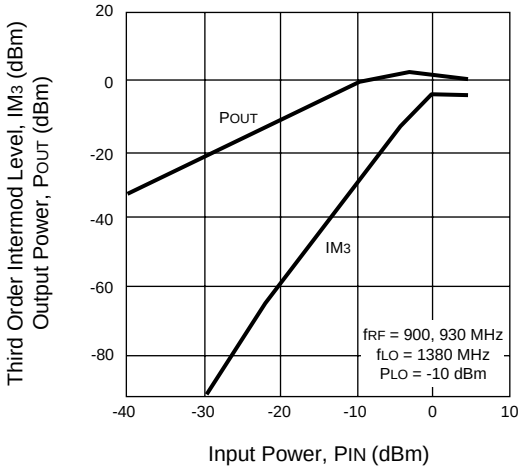
NOISE FIGURE vs. RF FREQUENCY (MIXER)



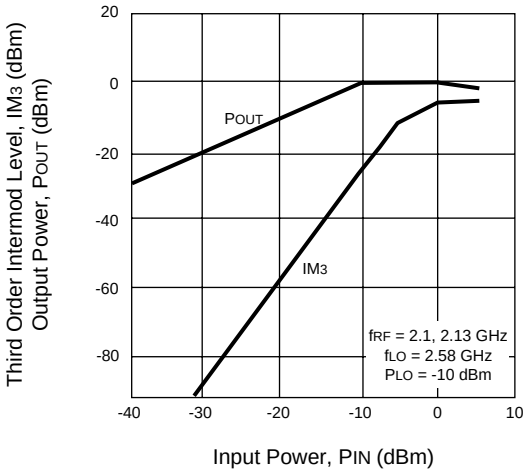
SUPPLY CURRENT vs. SUPPLY VOLTAGE



THIRD ORDER INTERMOD LEVEL and OUTPUT POWER vs. INPUT POWER (MIXER)

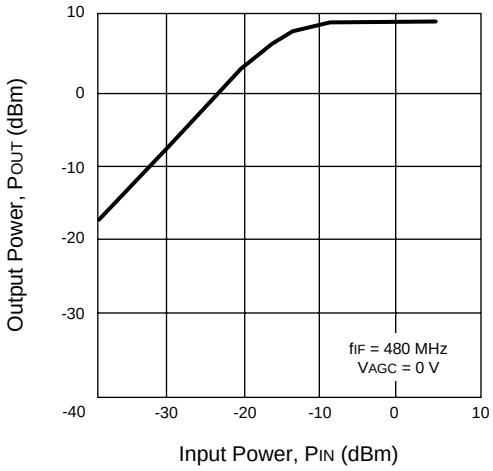


THIRD ORDER INTERMOD LEVEL and OUTPUT POWER vs. INPUT POWER (MIXER)

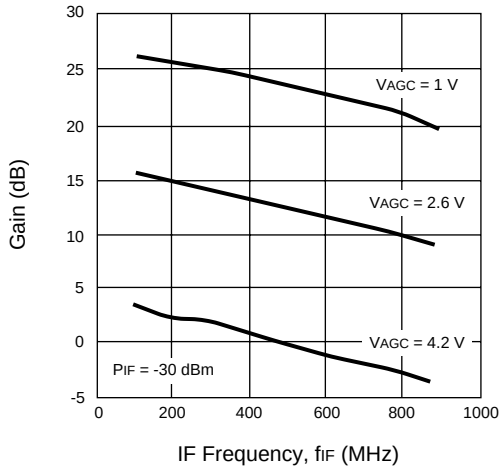


TYPICAL PERFORMANCE CURVES (TA = 25°C, VCC = 5 V)

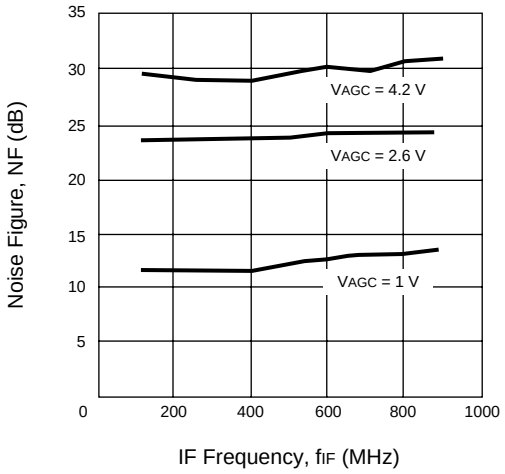
OUTPUT POWER vs. INPUT POWER (IF AMP)



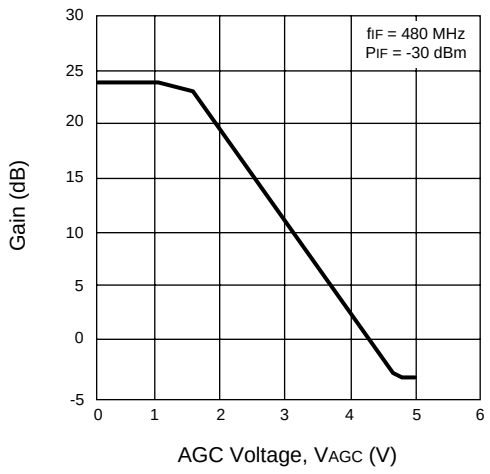
GAIN vs. IF FREQUENCY (IF AMP)



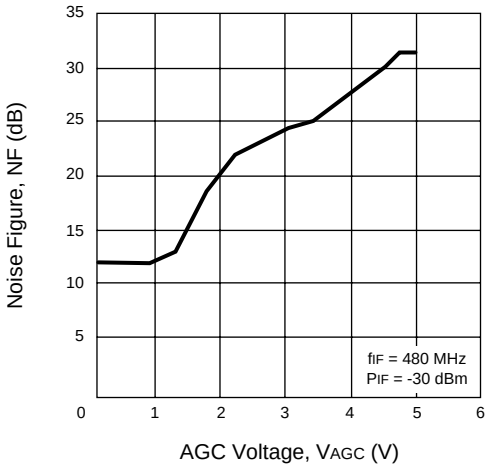
NOISE FIGURE vs. IF FREQUENCY (IF AMP)



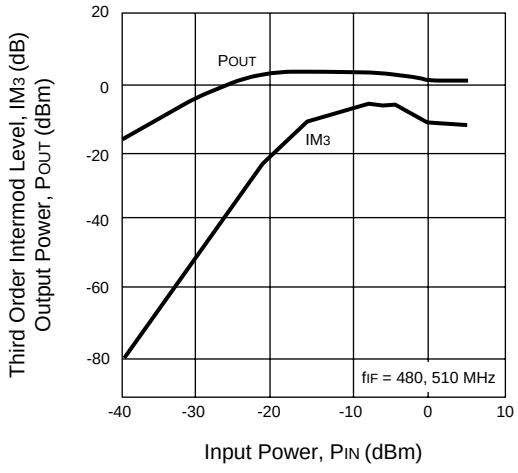
GAIN vs. AGC VOLTAGE (IF AMP)



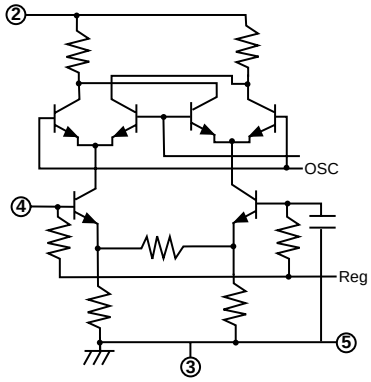
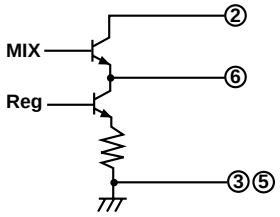
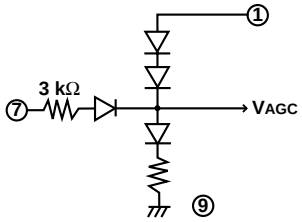
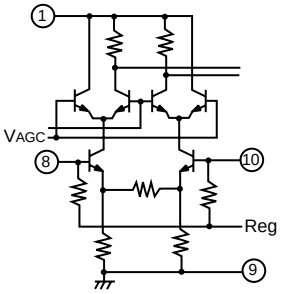
NOISE FIGURE vs. AGC VOLTAGE (IF AMP)



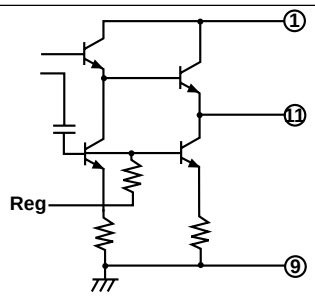
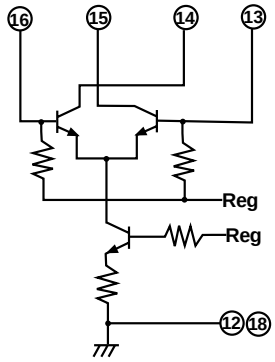
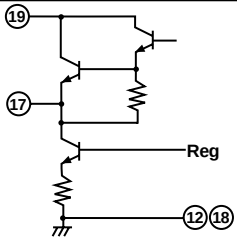
THIRD ORDER INTERMOD LEVEL and OUTPUT POWER vs. INPUT POWER (IF AMP)



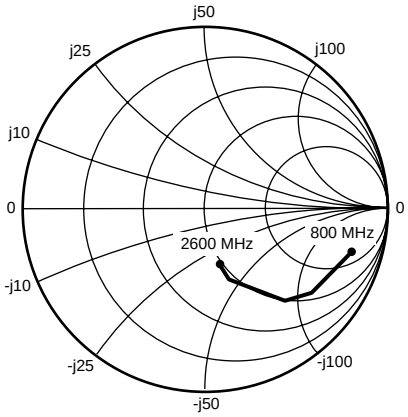
PIN CONNECTIONS

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 governs the AGC output level. Maximum gain at V_{AGC} = 0 V Minimum gain at V_{AGC} = 5 V	
8	IF IN	2.36	IF signal input pin of IF AGC Amp. In case of single input, this pin should be grounded through a 1000 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 CONNECTIONS

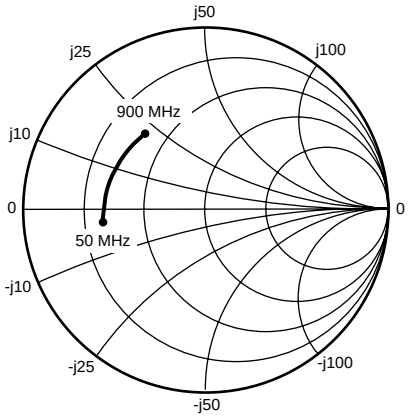
PIN NO.	SYMBOL	PIN VOLT TYP (V)	FUNCTIONS AND EXPLANATION	EQUIVALENT CIRCUIT
11	IF OUT	2.55	Output pin of IF AGC Amp. This pin is assigned for emitter follower push-pull output.	
12	GND (LO)	0.00	Ground pin of oscillator amplifier. Buffer amplifier, oscillator output.	
13	LO (B1)	2.30	Base Pin of oscillator. Connected to 14 pin through a capacitor.	
14	LO (C2)	5.00	Collector pin of oscillator. Connected to 15 pin through capacitor. Oscillator frequency bandwidth is dependent on this capacitor. This pin should be connected to Vcc through a 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 a 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.	

PORT IMPEDANCES



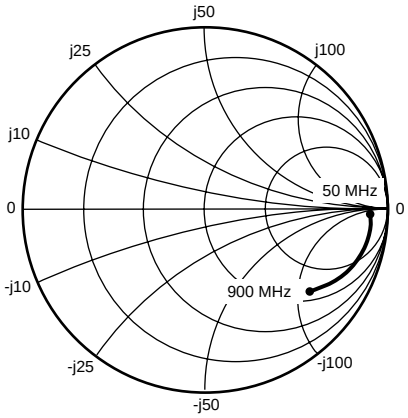
RF$_{IN}$ (PIN 4)

f (MHz)	MAG	ANG
800	0.849	-13.9
1000	0.820	-18.4
1200	0.791	-24.0
1400	0.767	-30.2
1600	0.718	-38.9
1800	0.635	-45.9
2000	0.567	-53.0
2200	0.485	-58.6
2400	0.402	-66.3
2600	0.290	-76.2



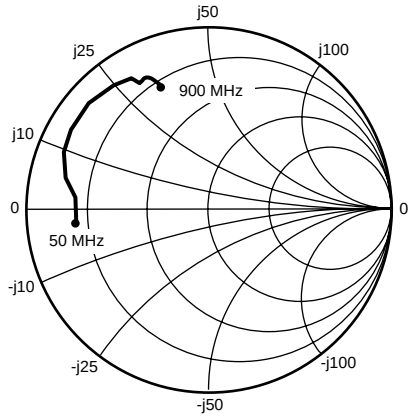
IF$_{OUT}$ (PIN 6)

f (MHz)	MAG	ANG
50	0.586	-175.3
100	0.562	174.9
200	0.571	165.0
300	0.566	156.4
400	0.559	149.6
500	0.560	144.1
600	0.550	139.5
700	0.548	135.8
800	0.540	132.9
900	0.538	130.6



IF AMP$_{IN}$ (PIN 10)

f (MHz)	MAG	ANG
50	0.894	-1.7
100	0.890	-3.6
200	0.891	-5.9
300	0.890	-9.6
400	0.884	-13.6
500	0.868	-17.9
600	0.839	-22.2
700	0.805	-26.2
800	0.769	-29.8
900	0.737	-33.0

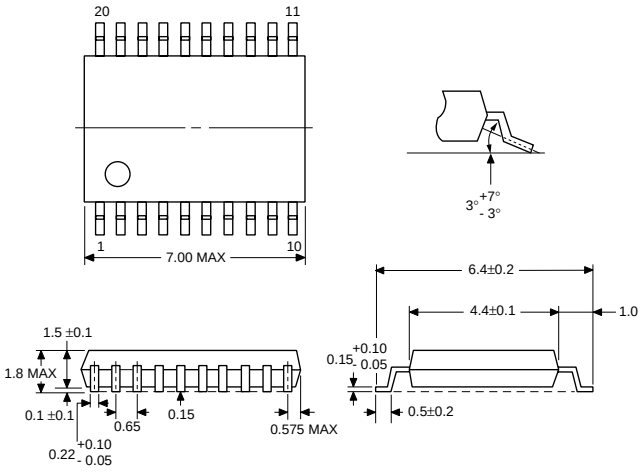


IF AMP$_{OUT}$ (PIN 11)

f (MHz)	MAG	ANG
50	0.750	-173.7
100	0.755	178.5
200	0.802	171.0
300	0.847	161.2
400	0.865	151.4
500	0.875	142.7
600	0.864	134.0
700	0.830	128.2
800	0.799	121.1
900	0.791	115.4

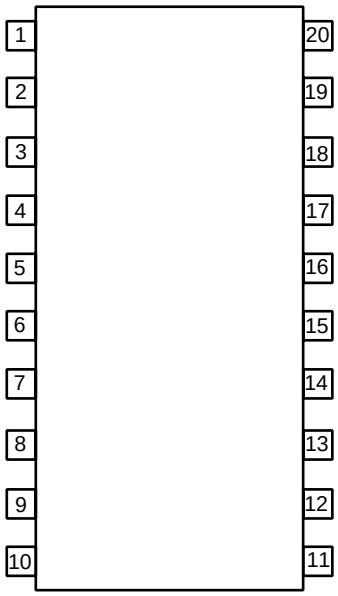
OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE S20



Lead Material: Alloy 42
Lead Plating: Lead Tin Alloy

PIN CONNECTIONS



PIN CONNECTIONS:

1.	V_{CC} (IF)	20.	V_{CC} (LO)
2.	V_{CC} (MIX)	19.	V_{CC} (LO_{OUT})
3.	GND (MIX)	18.	GND (LO)
4.	RF_{IN}	17.	LO_{OUT}
5.	GND (MIX)	16.	LO (B2)
6.	IF_{OUT}	15.	LO (C1)
7.	V_{AGC}	14.	LO (C2)
8.	$\overline{IF\ AMP_{IN}}$	13.	LO (B1)
9.	GND (IF)	12.	GND (LO)
10.	IF AMP_{IN}	11.	IF AMP_{OUT}

ORDERING INFORMATION

PART NUMBER	QTY
UPC2782GR-E1	2,500/Reel