

### FEATURES

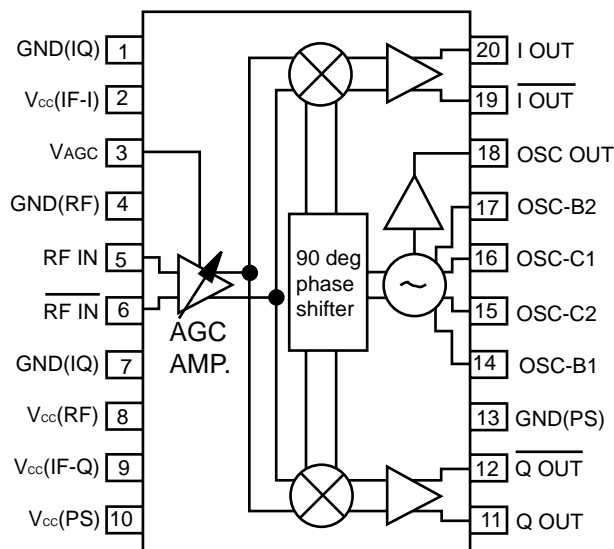
- **RF BANDWIDTH:**  
440 - 520 MHz
- **IF BANDWIDTH:**  
0.3 - 20 MHz
- **ON CHIP 90° PHASE SHIFTER**
- **IQ PHASE AND AMPLITUDE BALANCE**  
Amplitude Balance:  $\pm 0.5$  dB  
Phase Balance:  $\pm 2.0$  degree
- **LOW IM<sub>3</sub> DISTORTION:**  
35 dBc Typical
- **SMALL 20 PIN SSOP PACKAGE**
- **TAPE AND REEL PACKAGE AVAILABLE**

### DESCRIPTION

The UPC2781GR is a Silicon MMIC IQ demodulator manufactured with the NESAT III™ silicon bipolar process. The IC consists of an AGC amplifier, double balanced mixers, oscillator, 90° phase shifter, and I&Q output buffer amps. The device was specifically designed for DBS receivers and other digital communication systems.

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

### INTERNAL BLOCK DIAGRAM



### ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C, V<sub>CC</sub> = 5 V, Z<sub>L</sub> = 1k Ω)

PART NUMBER PACKAGE OUTLINE			UPC2781GR S20 (SSOP 20)		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I <sub>CC</sub>	Supply Current (no input signal)	mA	52	70	88
f <sub>RF</sub>	RF Input Bandwidth (f <sub>IF</sub> = 10 MHz, f <sub>RF</sub> > f <sub>LO</sub> , IQ Phase Balance < ± 1.5°)	MHz	440	480	520
f <sub>IF</sub>	IF Output Bandwidth (f <sub>RF</sub> = 480 MHz, P <sub>LO</sub> = -10 dBm, f <sub>RF</sub> > f <sub>LO</sub> , V <sub>AGC</sub> = 0 V)	MHz	0.3		20
CG	Conversion Gain (f <sub>RF</sub> = 480 MHz, f <sub>IF</sub> = 10 MHz, V <sub>AGC</sub> = 0 V)	dB		50	
NF	Noise Figure (f <sub>RF</sub> = 480 MHz, f <sub>IF</sub> = 10 MHz, P <sub>LO</sub> = -10 dBm, V <sub>AGC</sub> = 0 V)	dB		18	
IM <sub>3</sub>	3rd Order Intermodulation Distortion (f <sub>RF1</sub> = 480 MHz, f <sub>RF2</sub> = 481 MHz, f <sub>LO</sub> = 470 MHz, P <sub>LO</sub> = -10 dBm)	dBc		35	
ΔΦ	IQ Phase Balance (f <sub>RF</sub> = 480 MHz, f <sub>IF</sub> = 10 MHz, P <sub>RF</sub> = -30 dBm, P <sub>LO</sub> = -10 dBm)	deg	-2		+2
ΔG	IQ Amplitude Balance (f <sub>RF</sub> = 480 MHz, f <sub>IF</sub> = 10 MHz, P <sub>RF</sub> = -30 dBm, P <sub>LO</sub> = -10 dBm, V <sub>AGC</sub> = 0 V)	dB	-0.5		+0.5
G <sub>AGC</sub>	AGC Control Range (f <sub>RF</sub> = 480MHz, P <sub>RF</sub> = -30dBm, f <sub>IF</sub> = 10MHz, P <sub>LO</sub> = -10dBm, 0 ≤ V <sub>AGC</sub> ≤ 5 V)	dB	15	20	
LO-RF	LO to RF Isolation (f <sub>LO</sub> = 470 MHz, P <sub>LO</sub> = -10 dBm, P <sub>RF</sub> = -30 dBm, V <sub>AGC</sub> = 0 V)	dB		30	
LO-IF	LO to IF Isolation (f <sub>LO</sub> = 470 MHz, P <sub>LO</sub> = -10 dBm, P <sub>RF</sub> = -30 dBm, V <sub>AGC</sub> = 0 V)	dB		20	
P <sub>O</sub> (SAT)	Maximum Output Power (f <sub>RF</sub> = 480 MHz, f <sub>IF</sub> = 10 MHz, P <sub>RF</sub> = -10 dBm)	dBm		0	
V <sub>O</sub>	Output Voltage (f <sub>RF</sub> = 480 MHz, f <sub>IF</sub> = 10 MHz, P <sub>LO</sub> = -10 dBm, Z <sub>L</sub> = 1k Ω)	V <sub>P-P</sub>		1.0	

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** (TA = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
Vcc	Supply Voltage	V	6.0
PD	Power Dissipation <sup>2</sup>	mW	500
TOP	Operating Temperature Range	°C	-40 to +75
TSTG	Storage Temperature	°C	-55 to +150

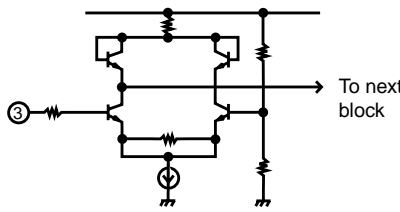
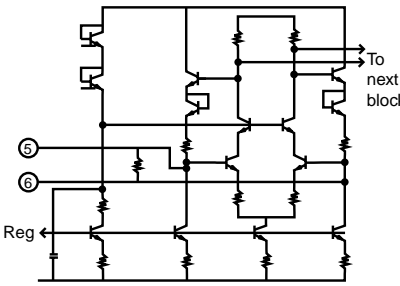
Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on a 50x50x1.6 mm epoxy glass PWB (TA = 75°C).

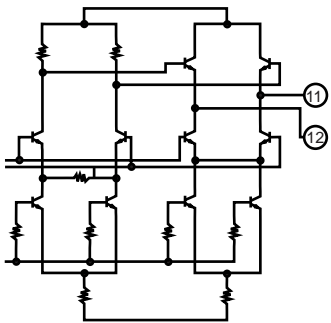
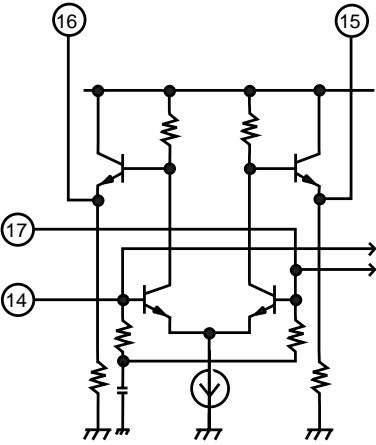
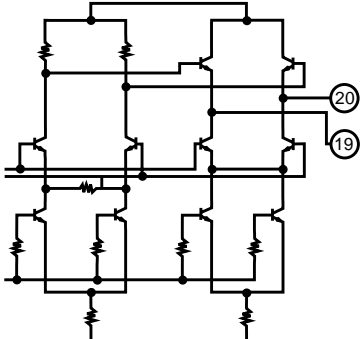
**RECOMMENDED OPERATING CONDITIONS**

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
Vcc	Supply Voltage	V	4.75	5.0	5.25
TOP	Operating Temperature	°C	-40	+25	+75

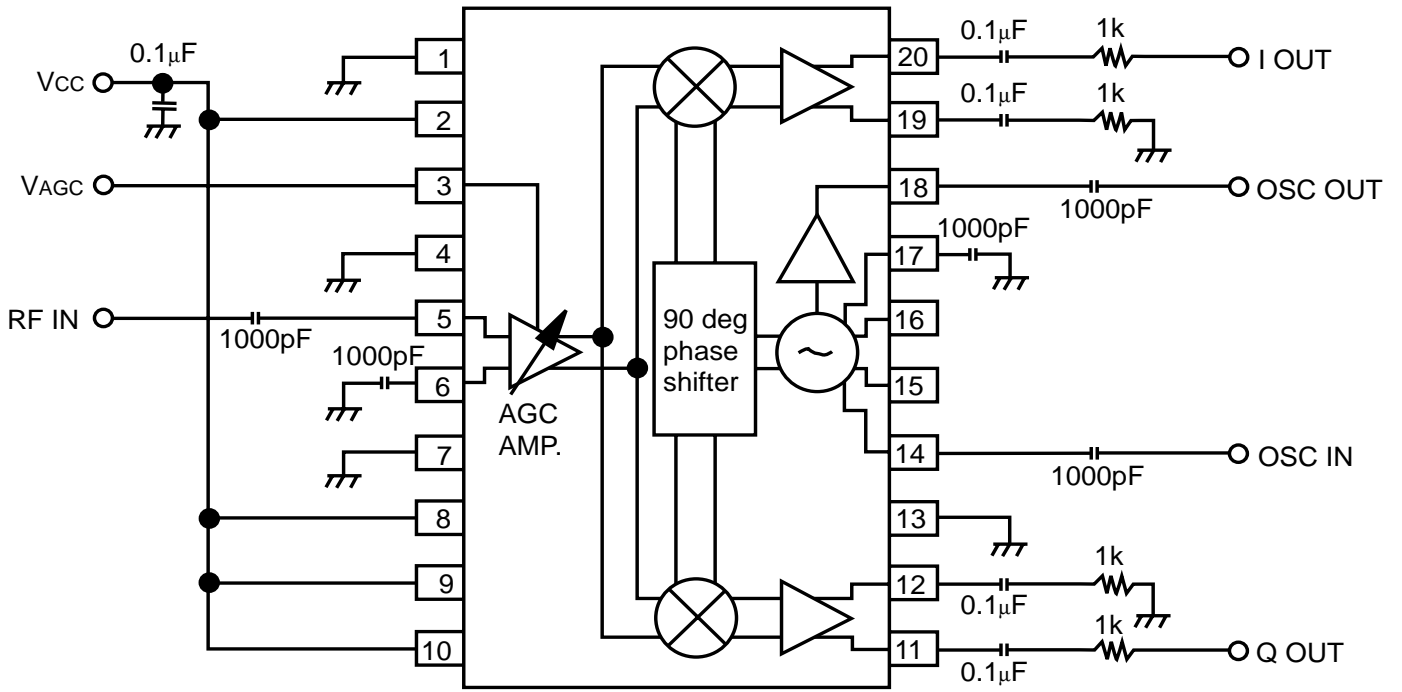
**PIN FUNCTIONS**

Pin No.	Pin Name	Pin Voltage Typ. (V)	Function and Explanation	Equivalent Circuit
1	GND(IQ)	0.0	Ground pin of IF (IQ) block.	
2	Vcc (IF I)	5.0	Power supply pin of I-output.	
3	VAGC	0.0 ~ 5.0	Gain control pin. <ul style="list-style-type: none"> <li>• VAGC = 0 V : Full gain</li> <li>• VAGC = 5 V : Minimum gain</li> </ul>	
4	GND(RF)	0.0	Ground pin of RF, Mixer and regulator block.	
5	RFIN	2.3	RF input pin. In case of single input, pin 6 should be bypassed with a capacitor.	
6	RFIN	2.3		
7	GND(IQ)	0.0	Ground pin of IF (IQ) block.	
8	Vcc (RF)	5.0	Power supply pin of RF, Mixer and regulator block.	
9	Vcc (IFQ)	5.0	Power supply pin of Q-output.	
10	Vcc (PS)	5.0	Power supply pin of Phase Shifter block.	

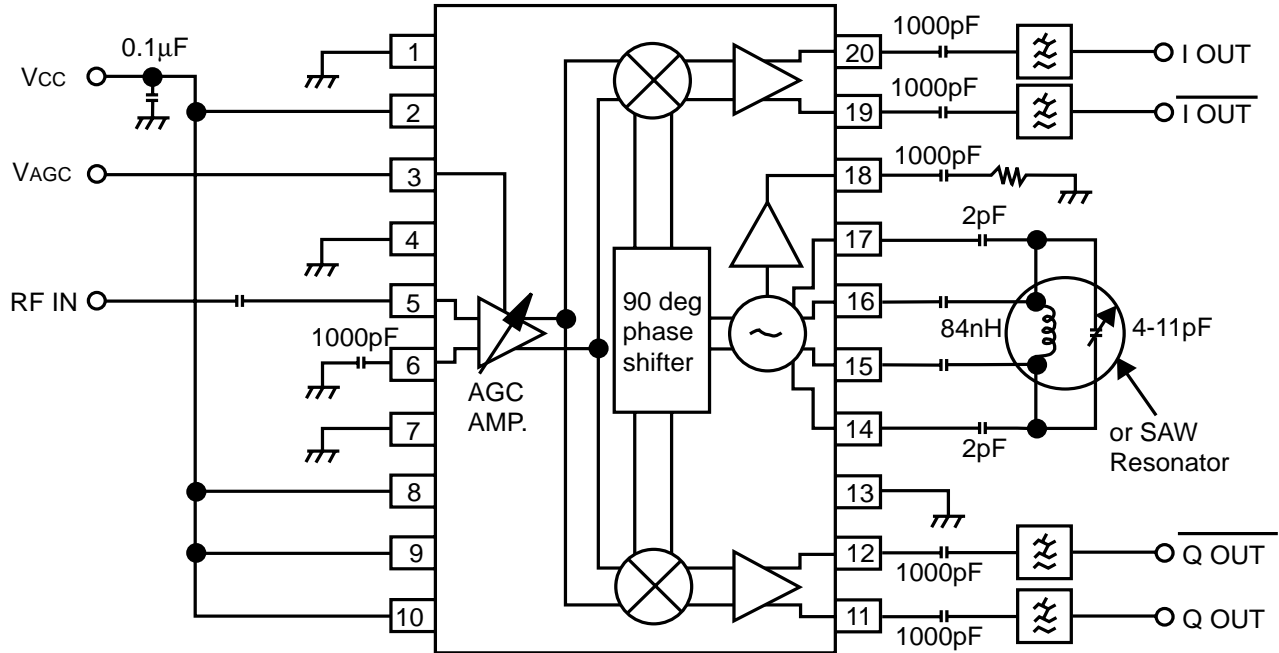
**PIN FUNCTIONS**

Pin No.	Pin Name	Pin Voltage Typ. (V)	Function and Explanation	Equivalent Circuit
11	Qout	2.4	Q-IF output pin. Pin 11 and pin 12 are balanced outputs.	
12	$\overline{Qout}$	2.4		
13	GND (IFQ)	0.0	Ground pin of Phase Shifter block.	
14	OSC-B1	3.0	Oscillator signal input pin. In case of single input, pin 17 should be bypassed with a capacitor.	
15	OSC-C2	4.5		
16	OSC-C1	4.5		
17	OSC-B2	3.0	Oscillator signal input pin. In case of single input, pin 14 should be bypassed with a capacitor.	
18	OSCOUT	3.8	Oscillator output.	
19	$\overline{Iout}$	2.4	I-IF output pin. Pin 19 and pin 20 are balanced outputs.	
20	Iout	2.4		

TEST CIRCUIT

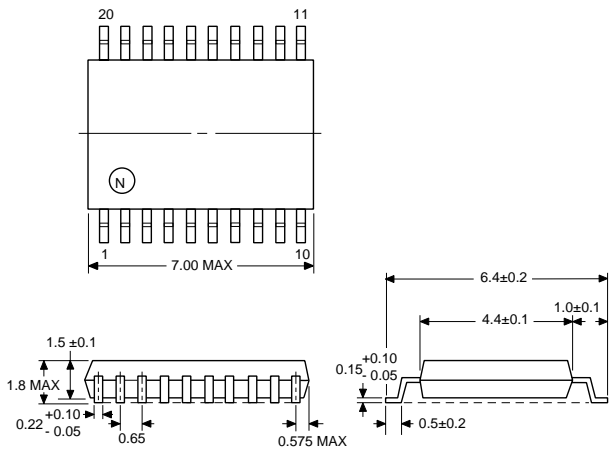


**APPLICATION CIRCUIT**



**OUTLINE DIMENSIONS** (Units in mm)

**PACKAGE OUTLINE SSOP 20**



Lead Material: Alloy 42  
Lead Plating: Lead Tin Alloy

**ORDERING INFORMATION**

PART NUMBER	QUANTITY
UPC2781GR-E1	2500/Reel

Note:  
Embossed Tape, 12 mm wide.

EXCLUSIVE NORTH AMERICAN AGENT FOR **NEC** RF, MICROWAVE & OPTOELECTRONIC SEMICONDUCTORS

**CEL CALIFORNIA EASTERN LABORATORIES** • Headquarters • 4590 Patrick Henry Drive • Santa Clara, CA 95054-1817 • (408) 988-3500 • Telex 34-6393 • FAX (408) 988-0279  
24-Hour Fax-On-Demand: 800-390-3232 (U.S. and Canada only) • Internet: <http://WWW.CEL.COM>

DATA SUBJECT TO CHANGE WITHOUT NOTICE

PRINTED IN USA ON RECYCLED PAPER -6/97