



NEC's 900 MHz SILICON MMIC DOWN CONVERTER

UPC1686GV

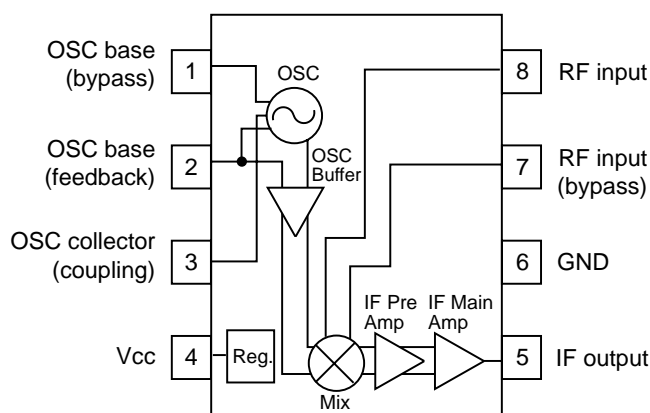
FEATURES

- **WIDE-BAND OPERATION:** DC to 890 MHz
- **DOUBLE BALANCED MIXER:**
 - Low Distortion
 - Low Oscillator Radiation
- **BALANCED AMPLIFIER FOR VOLTAGE CONTROLLED OSCILLATORS:**
 - Up to UHF Frequency
- **SINGLE ENDED PUSH-PULL IF AMPLIFIER:**
 - Constant Resistive Impedance
- **SWITCHABLE AS MIXER OR IF AMP**
- **SMALL PACKAGE:** 8 Pin SSOP

DESCRIPTION

NEC's UPC1686GV is a silicon monolithic integrated circuit designed as a wide-band mixer/oscillator/IF amp suitable for VHF TV/CATV tuners. Device features include: 20 dB gain from 55 to 890 MHz and an output power of +10 dBm at saturation. The device is available in an 8 pin SSOP package. The nominal output impedance of the device is 75 ohms.

INTERNAL BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS (T_A = 25°C, V_{CC} = 5 V)

PART NUMBER PACKAGE OUTLINE			UPC1686GV S08			TEST CIRCUIT
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	
I _{CC}	Circuit Current, no input signal	mA	25	38	48	Fig. 1
CG	Conversion Gain ¹					Fig. 1
	RF = 55 MHz, IF = 44 MHz	dB	15	19	22	
	RF = 200 MHz, IF = 50 MHz	dB	15.5	19.5	22.5	
	RF = 440 MHz, IF = 50 MHz	dB	16	20	23	
	RF = 890 MHz, IF = 50 MHz	dB		20		
NF	Noise Figure ² at RF = 55 MHz, IF = 44 MHz	dB		11	14	Fig. 1
	RF = 200 MHz, IF = 50 MHz	dB		11	14	
	RF = 440 MHz, IF = 50 MHz	dB		12	15	
CM	1% Cross modulation ³ at IF = 50 MHz, 75 Ω Open Terminal, RF = 55 to 470 MHz	dBμ		94		Fig. 1
PSAT	Saturated Output Power ⁴	dBm		+10		Fig. 1
f _{STB}	Oscillator Frequency Stability at V _{CC} ± 10% OSC f = 100 to 490 MHz	kHz		±100		Fig. 2
f _{DRIFT}	Oscillation Frequency Drift, OSC f = 100 to 490 MHz	kHz		100		Fig. 2
V _{OSC}	Oscillation Start Voltage OSC f = 100 to 490 MHz	V		3.0		Fig. 2
VSWR	IF Output			1.3	1.5	Fig. 1

Notes:

1. P_{RFin} = -40 dBm, P_{OSC} = -5 dBm

2. P_{OSC} = -5 dBm

3. Undesired = Desired ± 12 MHz, 30% 100 kHz AM S/I Ratio = 46 dB

4. P_{RFin} = 0 dBm, P_{OSC} = -5 dBm

ABSOLUTE MAXIMUM RATINGS¹ ($T_A = 25^{\circ}\text{C}$)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CC}	Supply Voltage	V	6
P _T	Total Power Dissipation ²	mW	250
T _{OP}	Operating Temperature	°C	-40 to +85
T _{STG}	Storage Temperature	°C	-65 to +150

Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. $T_A = 85^{\circ}\text{C}$ mounted on 50 x 50 x 1.6 (mm) PWB (glass-epoxy).

ORDERING INFORMATION

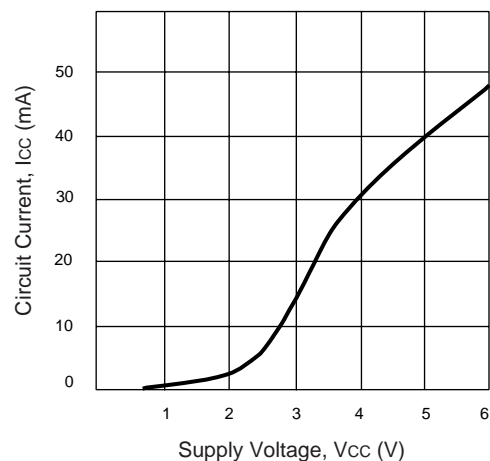
PART NUMBER	QUANTITY
UPC1686GV-E1-A	1000/REEL

PIN DESCRIPTION

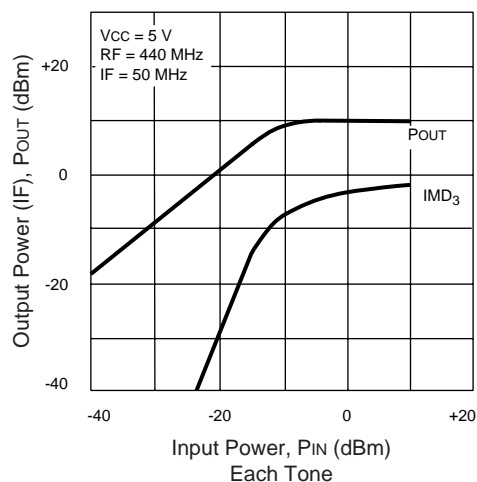
PIN NO.	SYMBOL	FUNCTION AND APPLICATION	EQUIVALENT CIRCUIT
1	OSC Base (Bypass)	<p>Internal oscillator consists of a balanced amplifier. Pins 2 and 3 should be externally equipped with a tank resonator circuit in order to oscillate with feedback loop.</p> <p>Pin 1 should be grounded through a coupling capacitor (~10 pF).</p> <p>Pin 3 is an open collector. This pin should be coupled through resistor or choke coil in order to adjust Q and connect to supply voltage. In case of unstable oscillation, lowering the Q will help to stabilize the operation.</p>	
2	OSC Base (Feedback)		
3	OSC Collector (Coupling)		
4	V _{CC}	Supply voltage pin for the IC.	
5	IFOUT	IF output pin. IF amplifier is designed as a single-ended push-pull amplifier. This pin is an emitter follower output with a wideband 50 Ω impedance.	
6	GND	GND pin for the IC.	
7	RF IN2 (Bypass)	<p>Pins 7 and 8 are inputs to a double-balance mixer. Either pin can be used for input and bypass.</p>	
8	RF IN1		

TYPICAL PERFORMANCE CURVES ($T_A = 25^\circ\text{C}$)

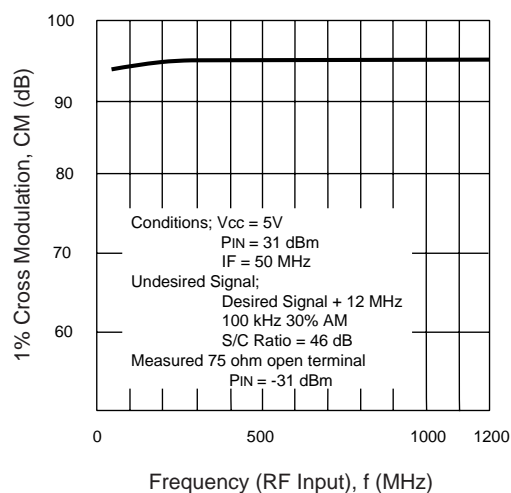
**CIRCUIT CURRENT vs.
SUPPLY VOLTAGE**



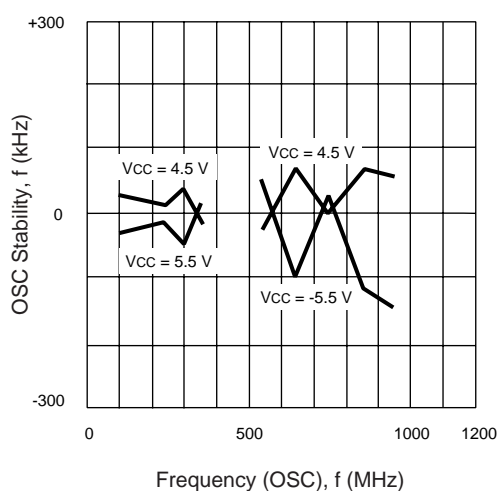
**OUTPUT POWER AND
INTERMODULATION DISTORTION
vs. INPUT POWER**



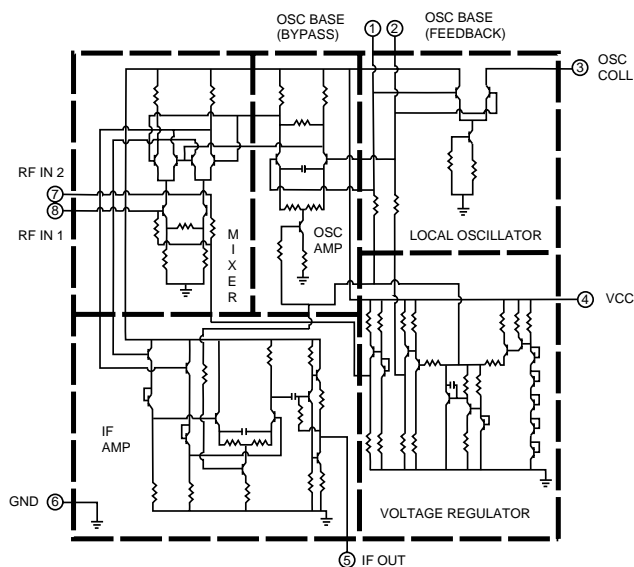
**1% CROSS MODULATION
vs. FREQUENCY**



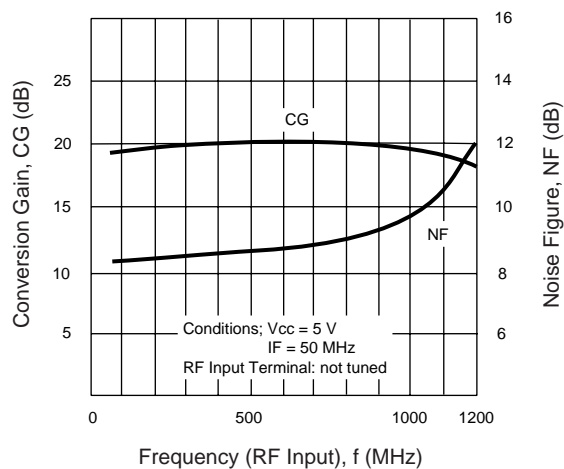
**OSC-FREQUENCY STABILITY
vs. FREQUENCY**



EQUIVALENT CIRCUIT



**CONVERSION GAIN AND NOISE
FIGURE vs. FREQUENCY**



The schematic diagram shows a central rectangular component with eight pins labeled 1 through 8. The connections are as follows:

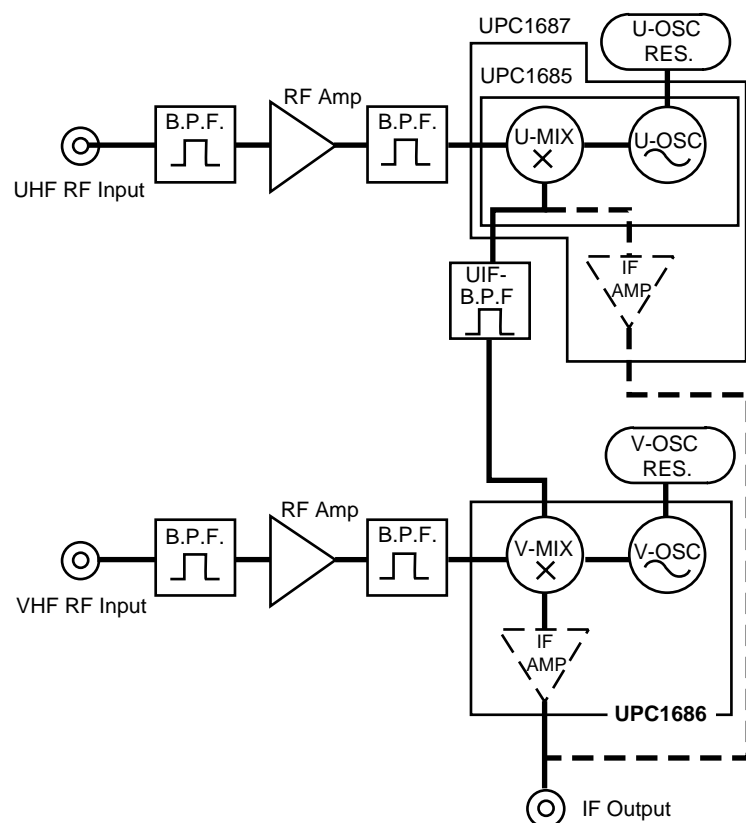
- VCC Input:** Connected to pin 4. The signal path includes a 47 Ω resistor and a 150 nH inductor in series. A 1000 pF capacitor is connected from the node after the resistor to ground.
- OSC Input:** Connected to pin 2. The signal path includes a 5 pF capacitor and a 1000 pF capacitor in series.
- IF Output:** Connected to pin 5. The output path includes a 1000 pF capacitor.
- RF Input:** Connected to pin 8. The input path includes a 1000 pF capacitor.
- Internal Connections:**
 - Pin 1 is connected to pin 2 via a capacitor (value not specified).
 - Pin 3 is connected to pin 4 via a capacitor (value not specified).
 - Pin 6 is connected to ground via a 4 pF capacitor.
 - Pin 7 is connected to ground via a 1000 pF capacitor.

[illegible]

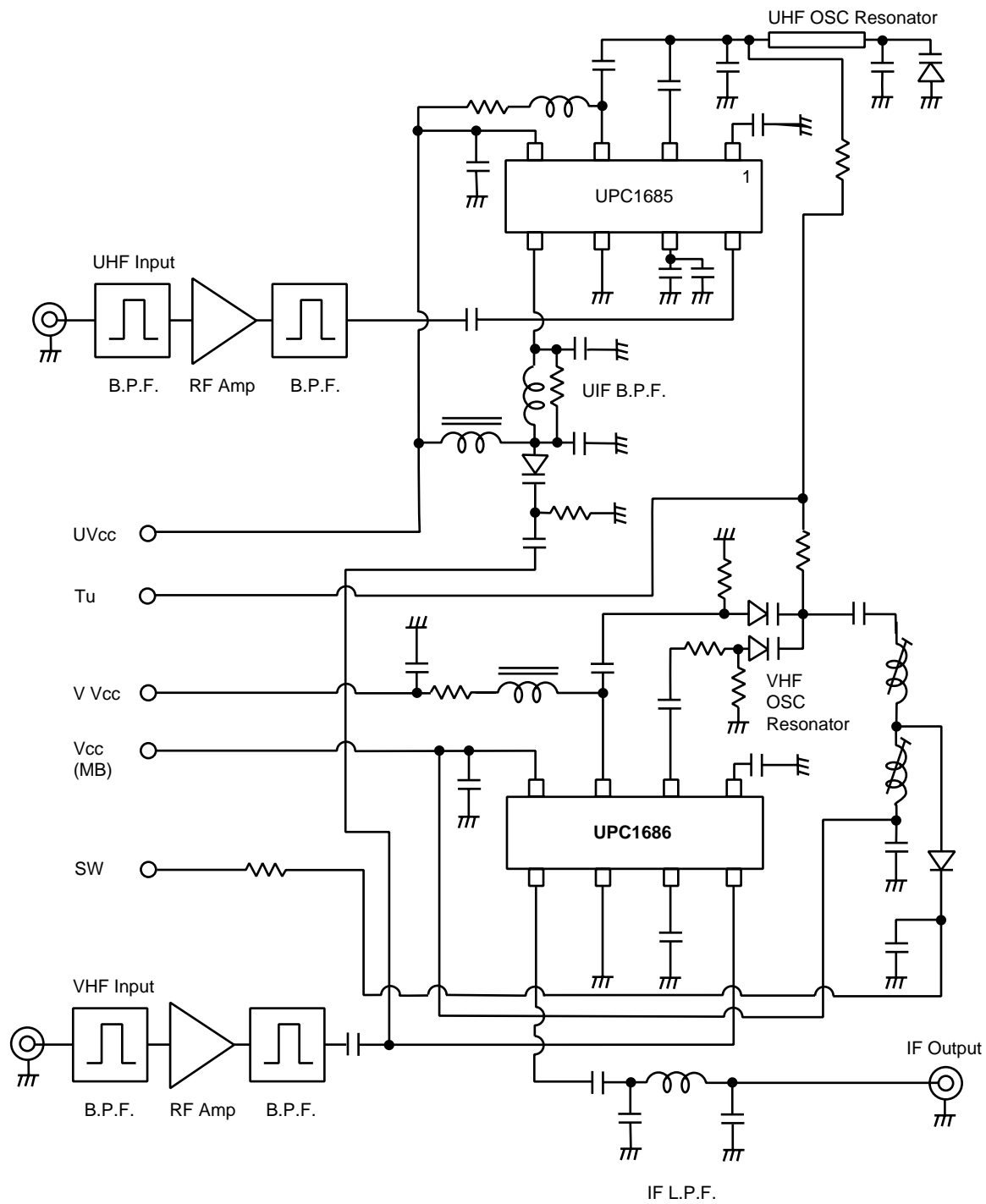
100 MHz to 550 MHz RF front end schematic diagram. The circuit includes an RF input matching network (L1, L2), a 100 pF coupling capacitor, a 100 MHz oscillator (OSC) with a 1SV164 diode and a 47 KΩ resistor, a 100 pF coupling capacitor, a 100 MHz oscillator (OSC) with a 1SV191 diode and a 47 KΩ resistor, a 100 pF coupling capacitor, a 100 MHz oscillator (OSC) with a 1SV164 diode and a 47 KΩ resistor, and a 100 pF coupling capacitor. The circuit is powered by VCC and ground. The output is an IF signal. Component values are specified for 100 MHz, 250 MHz, 520 MHz, and 550 MHz.

Frequency	Component	Value
100 MHz	C1	8 pF
100 MHz	L1	φ0.3 φ3.5 24T
100 MHz	L2	φ0.3 φ3.5 32T
250 MHz	C1	4 pF
250 MHz	L1	φ0.4 φ3.2 3T
250 MHz	L2	φ0.4 φ4.0 7T
520 MHz	C1	2 pF
520 MHz	L1	φ0.4 φ3.5 2T
520 MHz	L2	φ0.5 φ3.5 2T

APPLICATION BLOCK DIAGRAM FOR T.V. TUNER

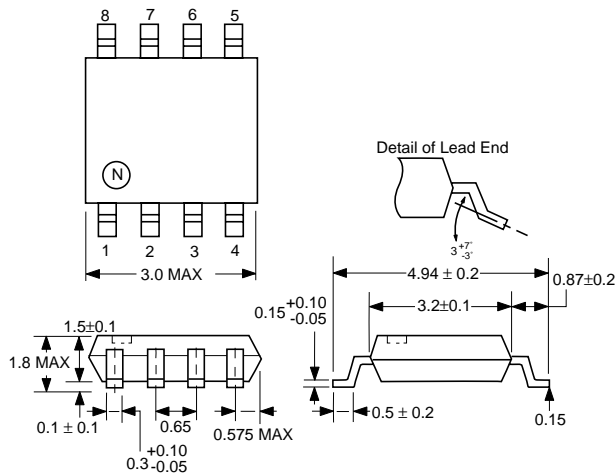


APPLICATION CIRCUIT FOR T.V. TUNER



OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE S08



PIN CONNECTION

1. OSC-Base (Bypass)
2. OSC-Base (Feedback)
3. OSC-Collector (Coupling)*
4. Vcc
5. IF OUT
6. GND
7. RF IN (Bypass)
8. RF IN

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NEC

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		-A	-AZ
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Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

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