



# NEC's 900 MHz SILICON MMIC DOWN CONVERTER

## UPC1686GV

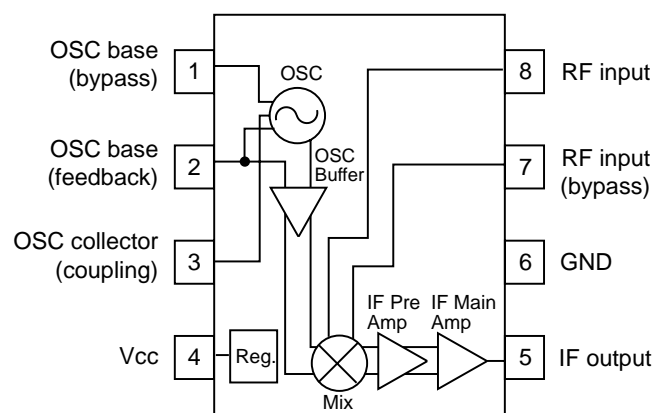
### FEATURES

- **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 (TA = 25°C, VCC = 5 V)

PART NUMBER PACKAGE OUTLINE			UPC1686GV S08			TEST CIRCUIT
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX	
I <sub>CC</sub>	Circuit Current, no input signal	mA	25	38	48	Fig. 1
CG	Conversion Gain <sup>1</sup>					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	
NF	Noise Figure <sup>2</sup> 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 <sup>3</sup> at IF = 50 MHz, 75 Ω Open Terminal, RF = 55 to 470 MHz	dBμ		94		Fig. 1
PSAT	Saturated Output Power <sup>4</sup>	dBm		+10		Fig. 1
f <sub>STB</sub>	Oscillator Frequency Stability at V <sub>CC</sub> ± 10% OSC f = 100 to 490 MHz	kHz		±100		Fig. 2
f <sub>DRIFT</sub>	Oscillation Frequency Drift, OSC f = 100 to 490 MHz	kHz		100		Fig. 2
V <sub>OSC</sub>	Oscillation Start Voltage OSC f = 100 to 490 MHz	V		3.0		Fig. 2
V <sub>SWR</sub>	IF Output			1.3	1.5	Fig. 1

Notes:

1. P<sub>RFIn</sub> = -40 dBm, P<sub>OSC</sub> = -5 dBm
2. P<sub>OSC</sub> = -5 dBm
3. Undesired = Desired ± 12 MHz, 30% 100 kHz AM S/I Ratio = 46 dB
4. P<sub>RFIn</sub> = 0 dBm, P<sub>OSC</sub> = -5 dBm

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** (T<sub>A</sub> = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V <sub>CC</sub>	Supply Voltage	V	6
P <sub>T</sub>	Total Power Dissipation <sup>2</sup>	mW	250
T <sub>OP</sub>	Operating Temperature	°C	-40 to +85
T <sub>STG</sub>	Storage Temperature	°C	-65 to +150

Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. T<sub>A</sub> = 85°C mounted on 50 x 50 x 1.6 (mm) PWB (glass-epoxy).

**ORDERING INFORMATION**

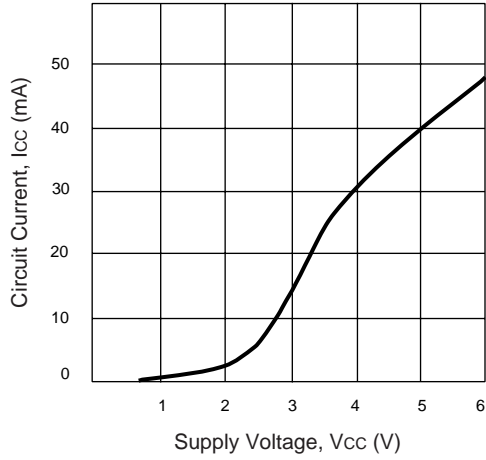
PART NUMBER	QUANTITY
UPC1686GV-E1-A	1000/REEL

**PIN DESCRIPTION**

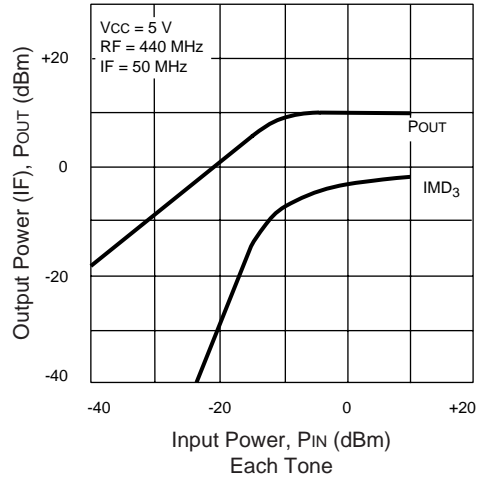
PIN NO.	SYMBOL	FUNCTION AND APPLICATION	EQUIVALENT CIRCUIT
1	OSC Base (Bypass)	<p>Internal oscillator consists of a balanced amplifier. Pins 2 and 3 should be externally equipped with a tank resonator circuit in order to oscillate with feedback loop.</p> <p>Pin 1 should be grounded through a coupling 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 <sub>CC</sub>	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	RFIN1		

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

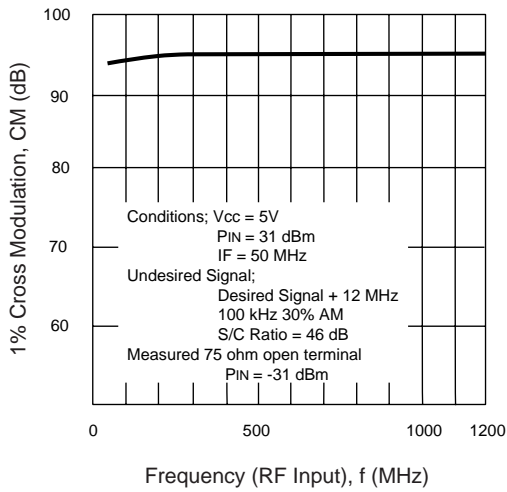
**CIRCUIT CURRENT vs. SUPPLY VOLTAGE**



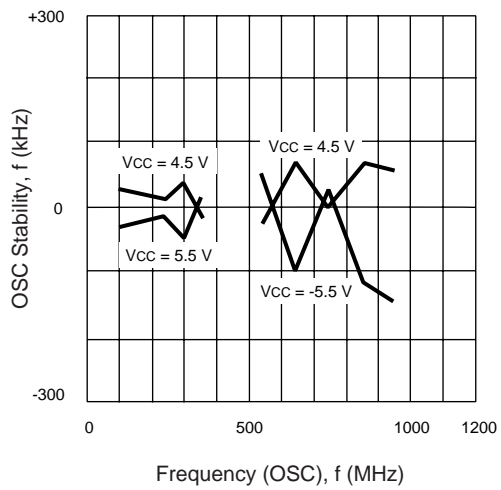
**OUTPUT POWER AND INTERMODULATION DISTORTION vs. INPUT POWER**



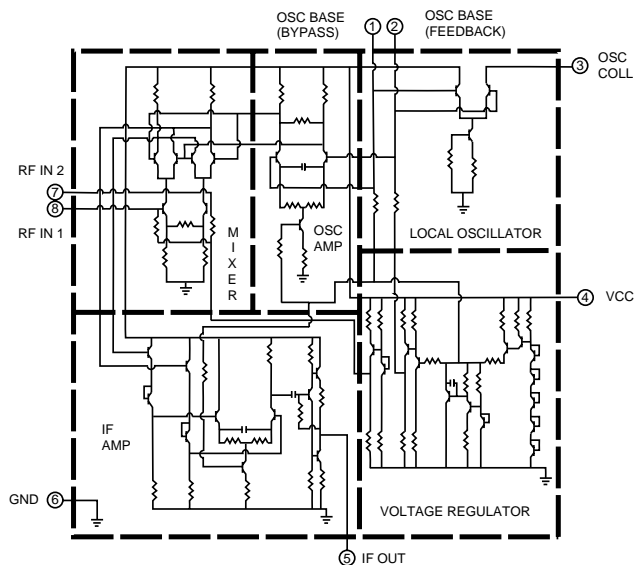
**1% CROSS MODULATION vs. FREQUENCY**



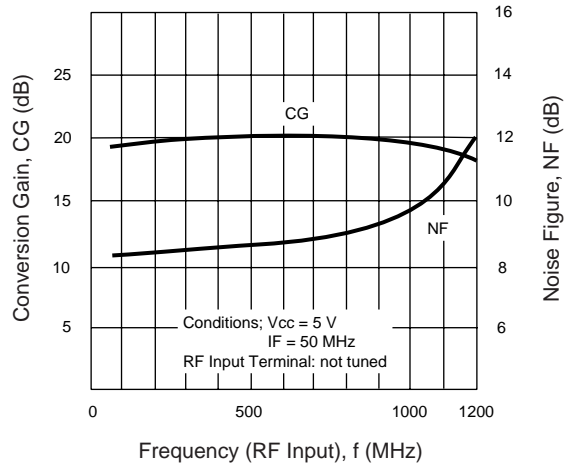
**OSC-FREQUENCY STABILITY vs. FREQUENCY**



**EQUIVALENT CIRCUIT**



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



TEST CIRCUITS

Figure 1

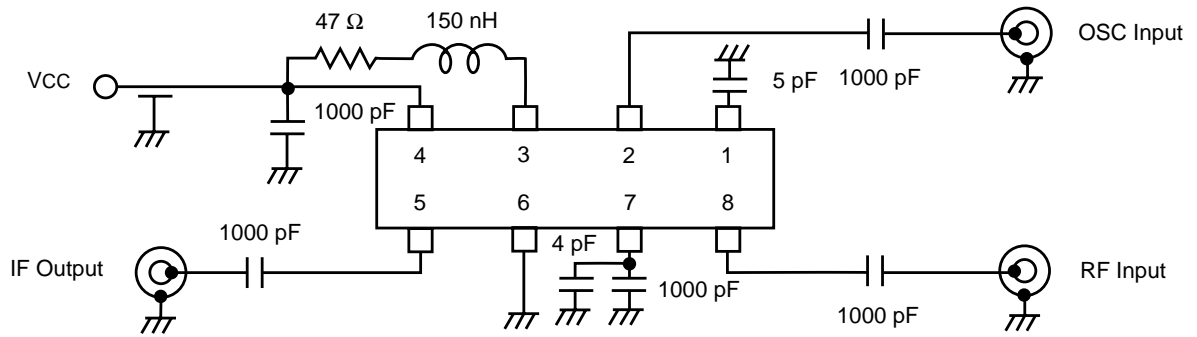
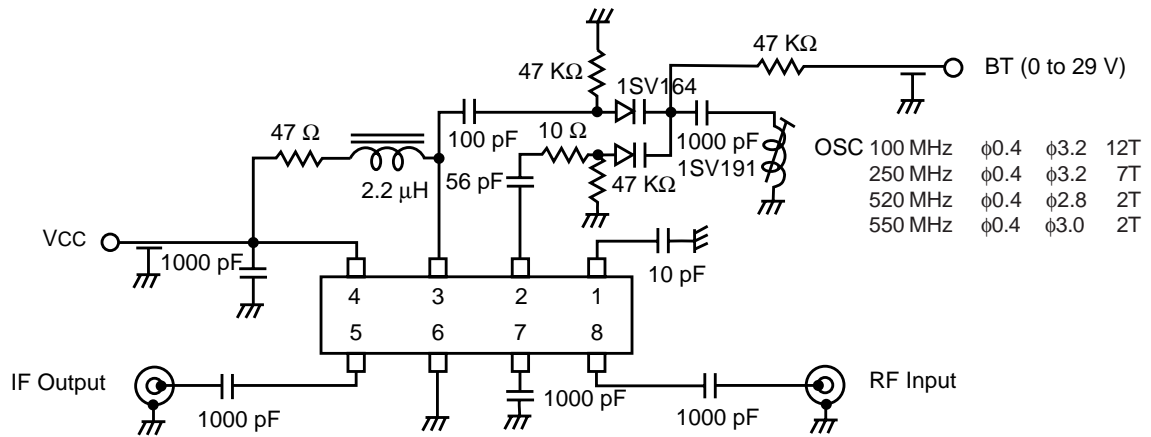
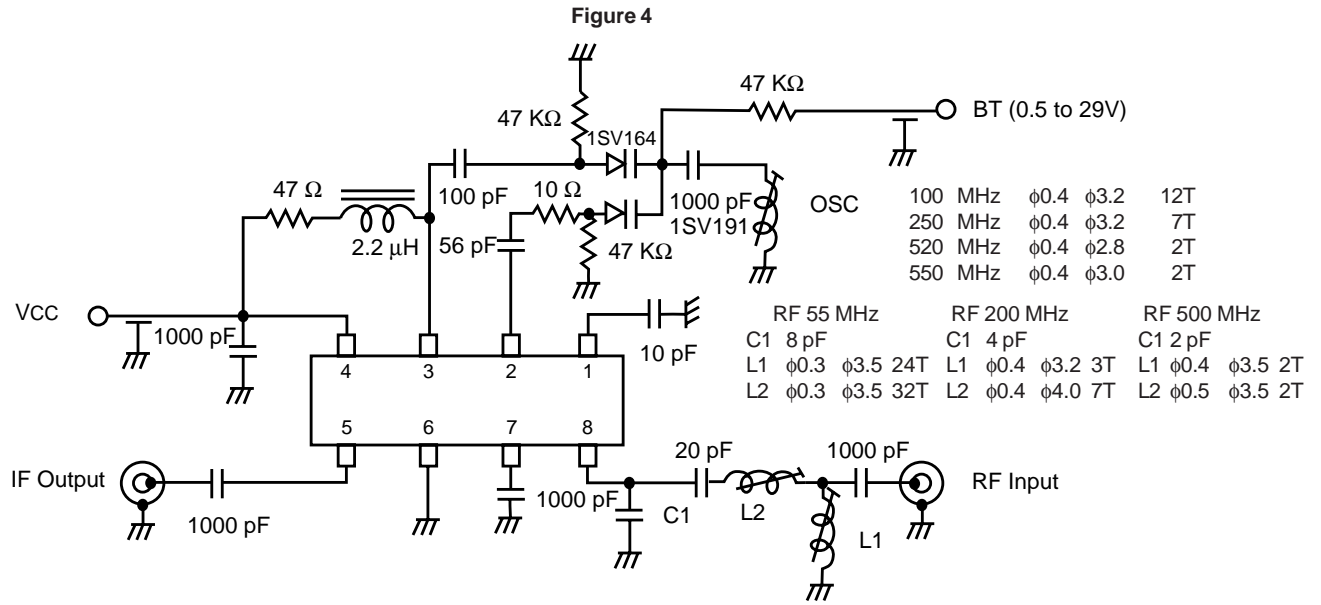


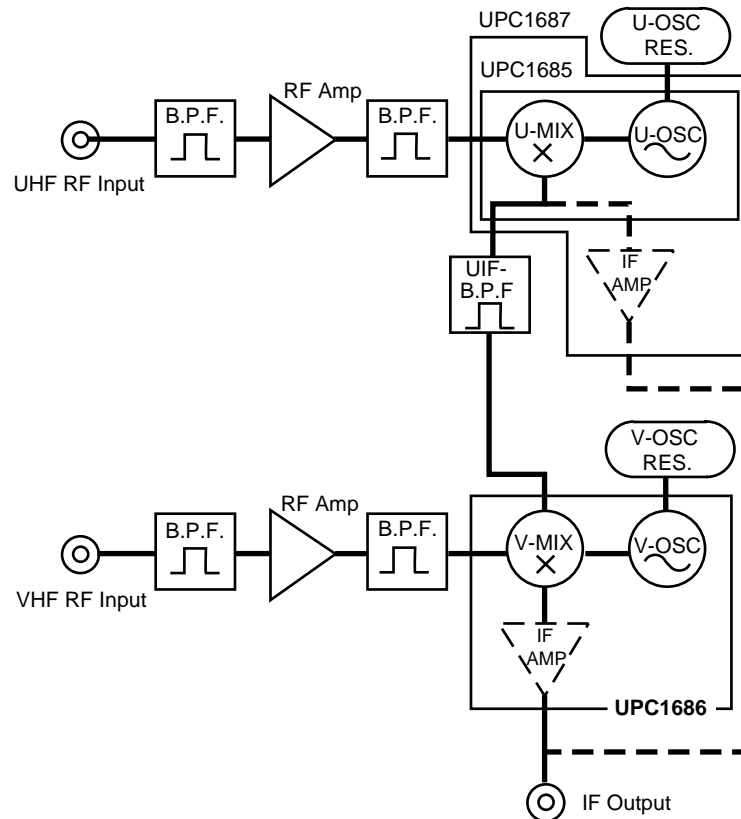
Figure 2



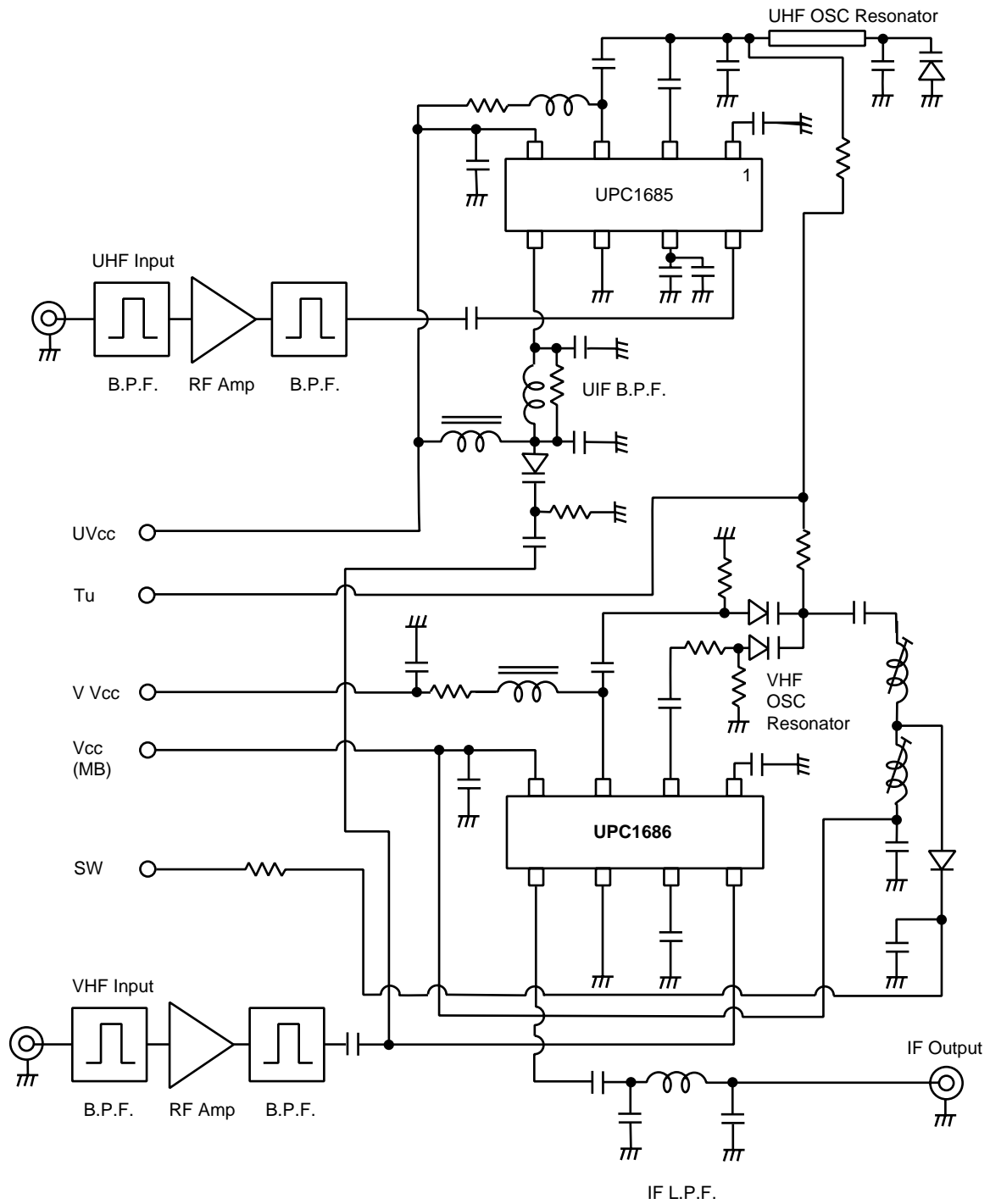
TYPICAL APPLICATION CIRCUIT



APPLICATION BLOCK DIAGRAM FOR T.V. TUNER

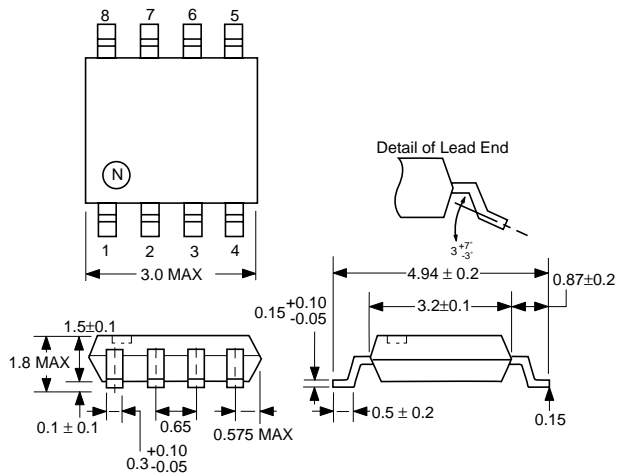


APPLICATION CIRCUIT FOR T.V. TUNER



## 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

### Life Support Applications

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**NEC**

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This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
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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