DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1694

GENERAL PURPOSE HIGH FREQUENCY WIDE BAND IC FOR DOWN CONVERTER

DESCRIPTION

The μPC1694GR is Silicon monolithic IC for down converter that is capable of operating up to 1 GHz.

This IC consists of double balanced mixer (DBM), local oscillator and IF amplifier. Furthermore, combination with the μPC1663G (high-speed video amp) enables it to be applied to a FM demodulation circuit such as DBS tuner.

The package is 14 pin SOP suitable for smaller mounting area.

FEATURES

- Satisfactory 1% cross modulation distortion characteristics: CM = 103 dBμ @ f_{des} = 200 MHz
- Wide band operation: f ≤ 1 GHz
- Low carrier leakage due to double balanced mixer (DBM)
- Easy to connect with varactor diode due to balanced amplifier oscillator
- Single-end push-pull IF amplifier suppresses fluctuation in output impedance
- Supply voltage: 5 V
- Packaged in 14 pin SOP suitable for smaller mounting area

ORDERING INFORMATION

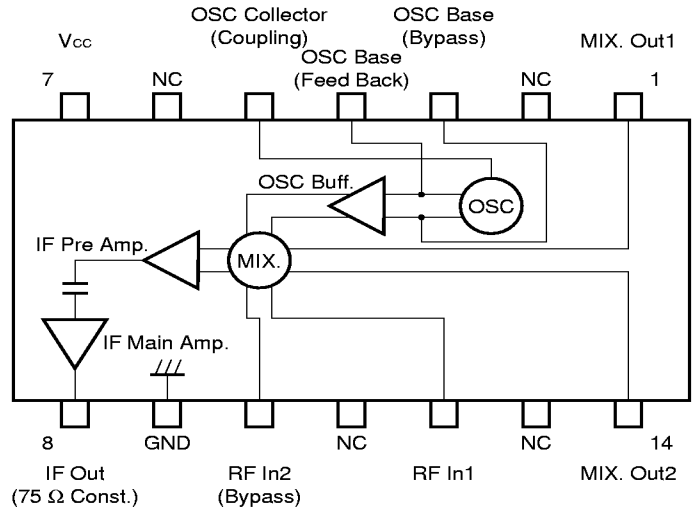
PART NUMBER	PACKAGE	PACKAGE STYLE
μPC1694GR-E1	14 pin plastic SOP (225 mil)	Embossed tape 16 mm wide. Pin 1 indicates pull-out direction of tape.
μPC1694GR-E2	14 pin plastic SOP (225 mil)	Embossed tape 16 mm wide. Pin 1 indicates roll-in direction of tape.

Remark For evaluation sample order, please contact your local NEC office.
(Part number for sample order: μPC1694GR)

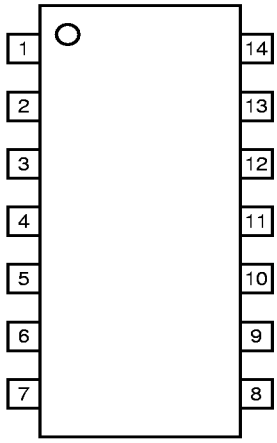
Caution: Electro-static sensitive devices

Document No. P12965EJ2V0DS00 (2nd edition)
Date Published October 1997 N
Printed in Japan

INTERNAL BLOCK DIAGRAM



PIN CONFIGURATION (Top View)



1. MIX output 1
2. GND (Non Connection)
3. OSC base (bypass)
4. OSC base (feedback)
5. OSC collector (coupling)
   (MIX/IF Amp. switch)
6. GND (Non Connection)
7. V_{CC}
8. IF output (75 Ω)
9. GND
10. RF input 2 (bypass)
11. GND (Non Connection)
12. RF input 1
13. GND (Non Connection)
14. MIX output 2

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

PARAMETER	SYMBOL	RATING	UNIT	TEST CONDITION
Supply Voltage	V_{CC}	6.0	V	
Power Dissipation	P_D	375	mW	T_A = 85°C Note 1
Operating Ambient Temperature	T_A	–40 to +85	°C	
Storage Temperature Range	T_{stg}	–65 to +150	°C	

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

RECOMMENDED OPERATING RANGE

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{CC}	4.5	5.0	5.5	V

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

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Circuit Current 1	I_{CC1}	32	40	48	mA	No input signal[*2]
Mixer Output Voltage	V_{MIX}	–30	0	+30	mV	1-14 pin voltage, No input signal[*2]
Conversion Gain 1	CG1	14	18	21	dB	f_{RF} = 55 to 470 MHz, f_{IF} = 50 MHz P_{RF} = –40 dBm RF Input Terminal: Non Tuned[*3]
Conversion Gain 2	CG2	14	18	21	dB	f_{RF} = 470 to 890 MHz, f_{IF} = 50 MHz P_{RF} = –40 dBm RF Input Terminal: Non Tuned[*4]
Noise Figure 1	NF1	—	12.5	15.0	dB	f_{RF} = 55 to 470 MHz, f_{IF} = 50 MHz RF Input Terminal: Non Tuned[*3]
Noise Figure 2	NF2	—	13.5	16.0	dB	f_{RF} = 470 to 890 MHz, f_{IF} = 50 MHz RF Input Terminal: Non Tuned[*4]
Output Power 1	$P_{O(sat)}1$	+8	+10	—	dBm	f_{RF} = 470 MHz, f_{IF} = 50 MHz, P_{RF} = 0 dBm[*3]
Output Power 2	$P_{O(sat)}2$	+8	+10	—	dBm	f_{RF} = 890 MHz, f_{IF} = 50 MHz, P_{RF} = 0 dBm[*4]
Circuit Current 2 (U/IF)	I_{CC2}	32	40	48	mA	No input signal[*2]
Power Gain (U/IF)	G_P	17	21	24	dB	f_{in} = 50 MHz, P_{in} = –40 dBm[*3]
Noise Figure 3 (U/IF)	NF3	—	12.0	15.0	dB	f_{in} = 50 MHz[*3]

Note 2. On test circuit 1
Note 3. On test circuit 2
Note 4. On test circuit 3

STANDARD CHARACTERISTICS (FOR REFERENCE) (T_A = 25°C, V_{CC} = 5 V)

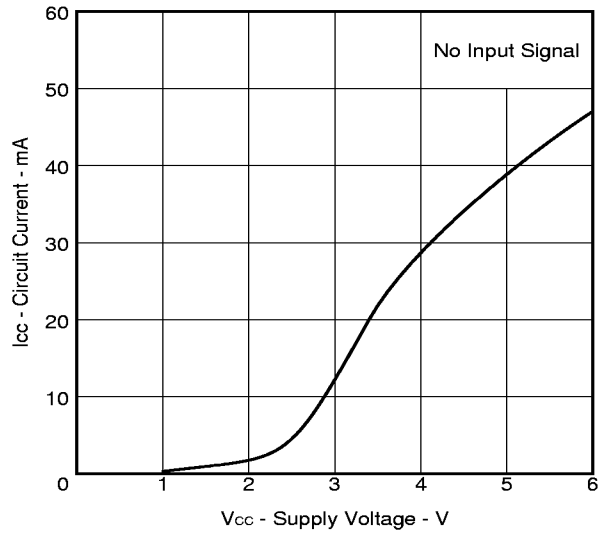
PARAMETER	SYMBOL	REFERENCE VALUE	UNIT	TEST CONDITIONS
Conversion Gain 3	CG3	24.5	dB	f_{RF} = 55 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm RF Input Terminal: Tuned[*3]
Conversion Gain 4	CG4	24.5	dB	f_{RF} = 200 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm RF Input Terminal: Tuned[*3]
Conversion Gain 5	CG5	23.0	dB	f_{RF} = 470 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm RF Input Terminal: Tuned[*3]
Conversion Gain 6	CG6	20.0	dB	f_{RF} = 890 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm RF Input Terminal: Tuned[*4]
1% Cross-modulation Distortion 1	CM1	103	dBμ	f_{des} = 55 to 470 MHz, f_{IF} = 50 MHz[*3, 5]
1% Cross-modulation Distortion 2	CM2	100	dBμ	f_{des} = 470 to 890 MHz, f_{IF} = 50 MHz[*4, 5]
1% Cross-modulation Distortion 3 (U/IF)	CM3	103	dBμ	f_{des} = 50 MHz[*3, 6]
Oscillation Frequency Stability 1	$f_{stb}1$	±100	kHz	V_{CC} ± 10%, f_{OSC} = 100 to 520 MHz[*3]
Oscillation Frequency Stability 2	$f_{stb}2$	±200	kHz	V_{CC} ± 10%, f_{OSC} = 520 to 940 MHz[*4]
Oscillation Stop (Start) Voltage 1	$V_{OSC}1$	2.5	V	f_{OSC} = 100 to 520 MHz[*3]
Oscillation Stop (Start) Voltage 2	$V_{OSC}2$	3.0	V	f_{OSC} = 520 to 940 MHz[*4]
Voltage Standing Wave Ratio	VSWR	1.3		f_{IF} = 30 to 60 MHz

Note 5. $f_{undes} = f_{des} \pm 12$ MHz, P_{in} = –31 dBm, f_{IF} = 50 MHz, AM: 100 kHz, 30%Mod., S/I Ratio = 46 dBc, Output 75 Ω Open

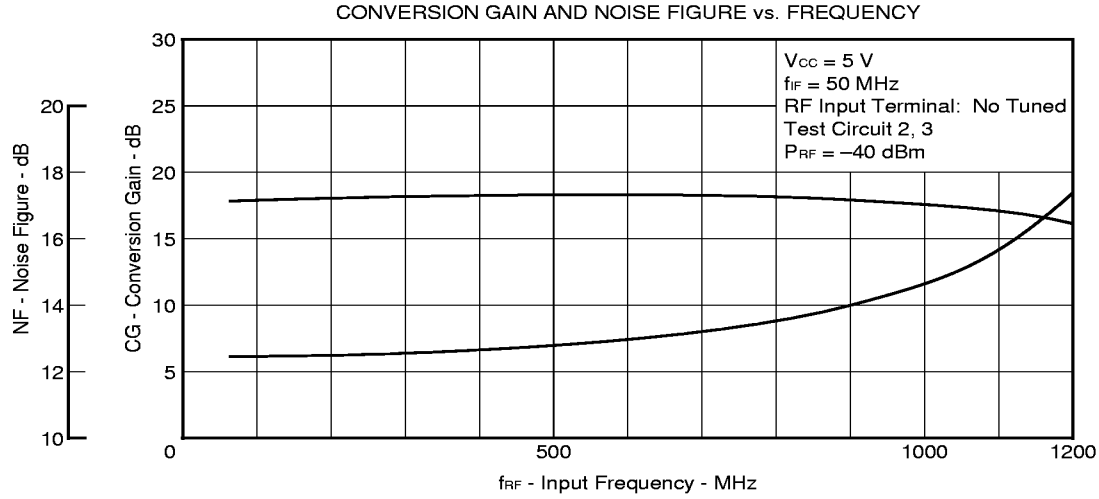
Note 6. f_{des} = 50 MHz, f_{undes} = 62 MHz, P_{in} = –31 dBm, AM: 100 kHz, 30% Mod., S/I Ratio = 46 dBc, Output 75 Ω Open

TYPICAL CHARACTERISTICS (T_A = 25°C)

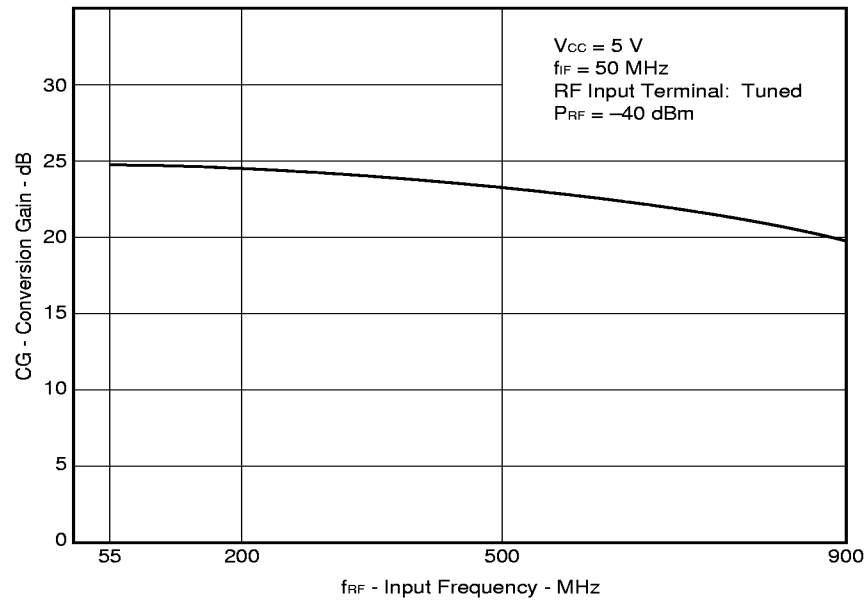
CIRCUIT CURRNT vs. SUPPLY VOLTAGE



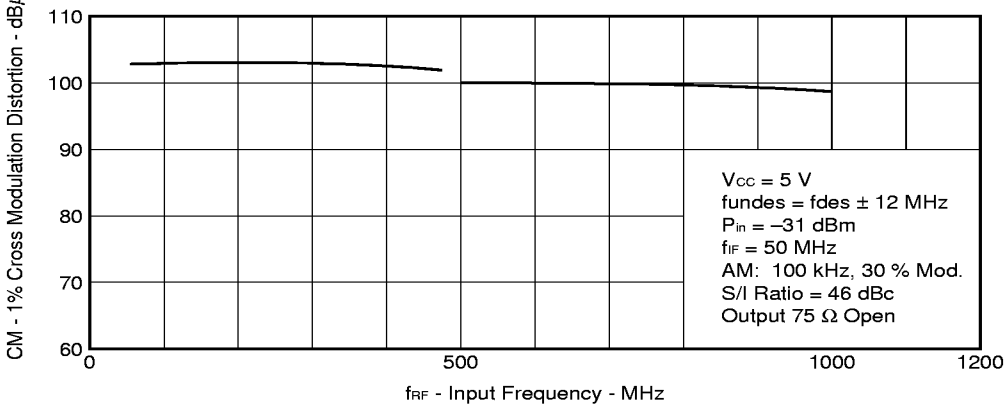
CONVERSION GAIN AND NOISE FIGURE vs. FREQUENCY



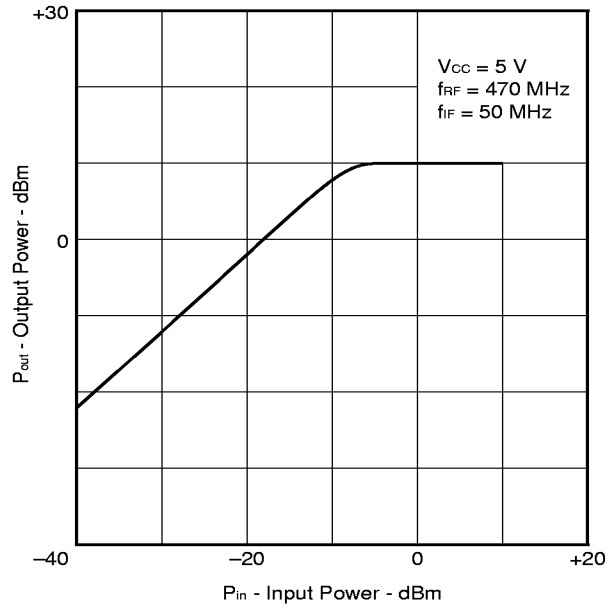
CONVERSION GAIN vs. FREQUENCY



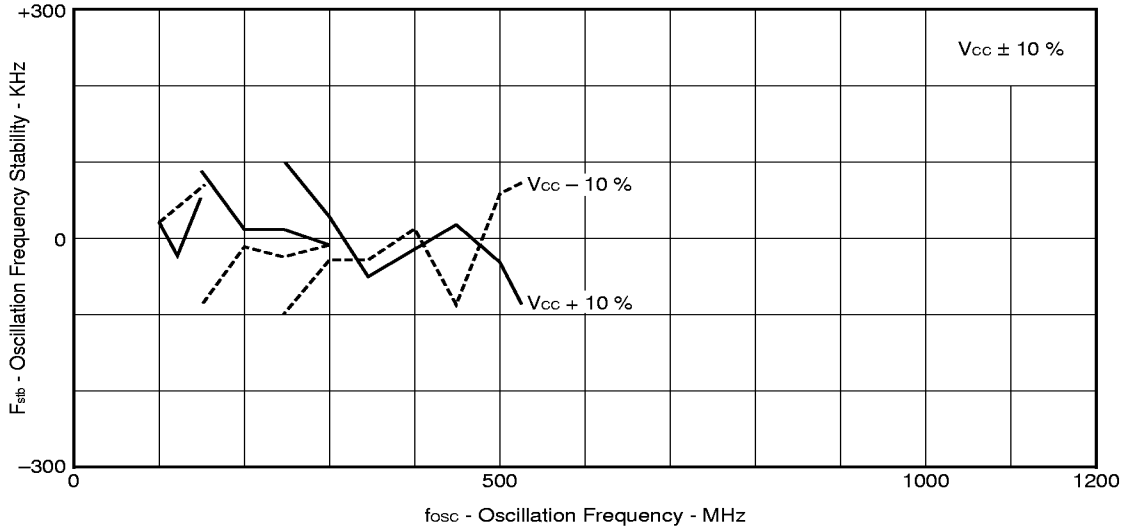
1% CROSS MODULATION DISTORTION vs. FREQUENCY



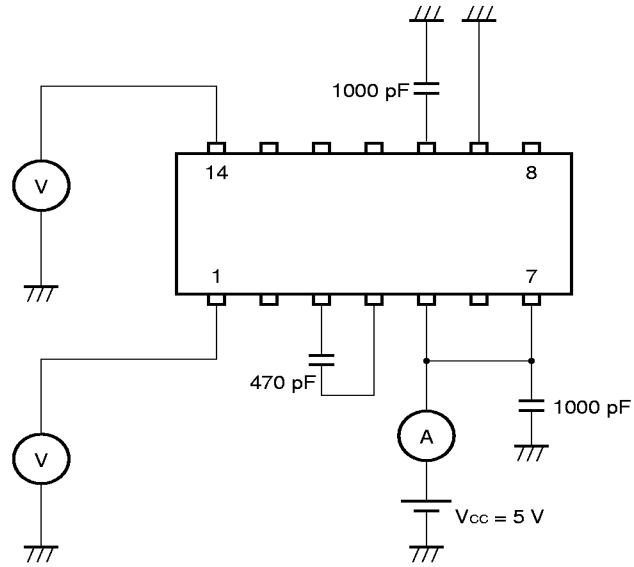
OUTPUT POWER vs. INPUT POWER



OSC-FREQUENCY STABILITY vs. FREQUENCY

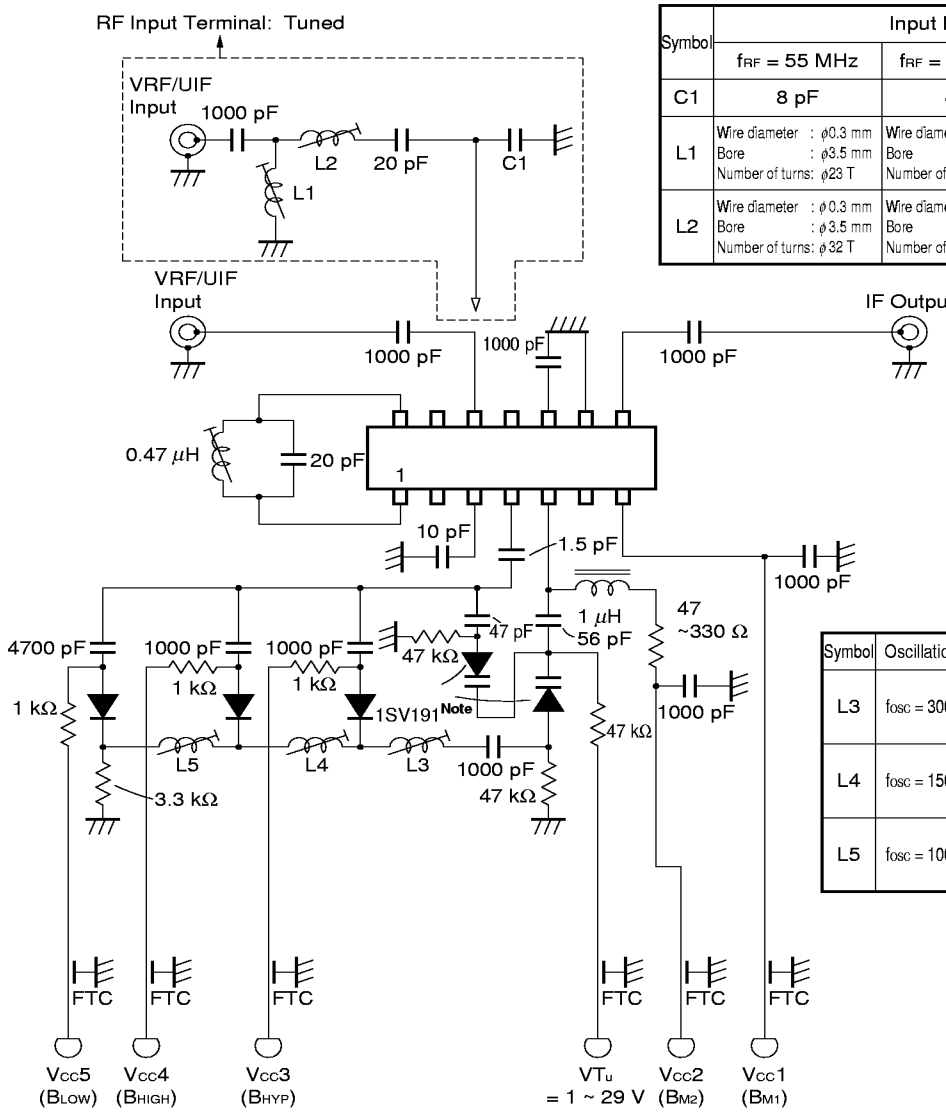


TEST CIRCUIT 1



When measuring circuit current with U/IF Amp, leave pin 5 open.

TEST CIRCUIT 2



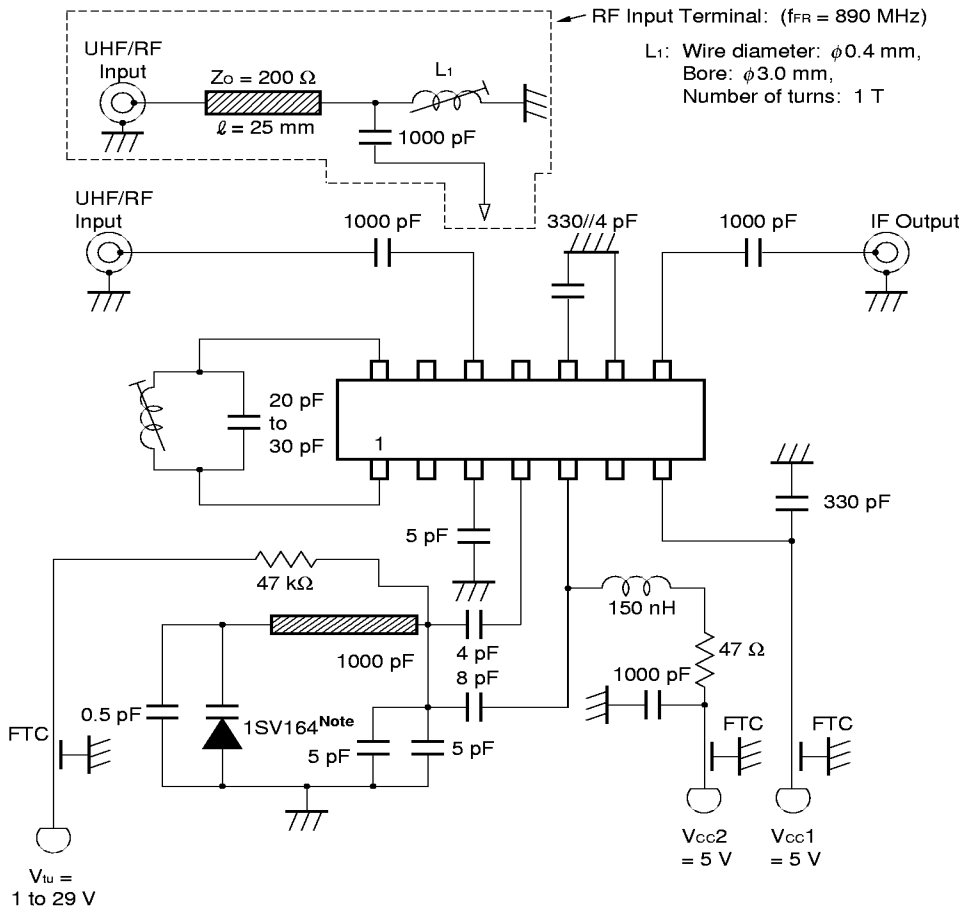
Symbol	Input Frequency		
	f_{RF} = 55 MHz	f_{RF} = 200 MHz	f_{RF} = 470 MHz
C1	8 pF	4 pF	2 pF
L1	Wire diameter : φ0.3 mm Bore : φ3.5 mm Number of turns: φ23 T	Wire diameter : φ0.4 mm Bore : φ3.2 mm Number of turns: φ3 T	Wire diameter : φ0.4 mm Bore : φ3.5 mm Number of turns: φ2 T
L2	Wire diameter : φ0.3 mm Bore : φ3.5 mm Number of turns: φ32 T	Wire diameter : φ0.3 mm Bore : φ4.0 mm Number of turns: φ7 T	Wire diameter : φ0.5 mm Bore : φ3.5 mm Number of turns: φ2 T

Symbol	Oscillation Frequency	Coil used
L3	fosc = 300 to 520 MHz	Wire diameter : φ0.5 mm Bore : φ3.0 mm Number of turns: φ2 T
L4	fosc = 150 to 300 MHz	Wire diameter : φ0.4 mm Bore : φ2.5 mm Number of turns: φ3 T
L5	fosc = 100 to 150 MHz	Wire diameter : φ0.4 mm Bore : φ3.0 mm Number of turns: φ9 T

	V_{CC1} (B_{M1})	V_{CC2} (B_{M2})	V_{CC3} (B_{HYP})	V_{CC4} (B_{HIGH})	V_{CC5} (B_{LOW})
V_{LOW}	5 V	5 V	OPEN	OPEN	5 V
V_{HIGH}	5 V	5 V	OPEN	5 V	OPEN
V_{HYPER}	5 V	5 V	5 V	OPEN	OPEN
U/IF	5 V	OPEN	OPEN	OPEN	OPEN

Note Our varactor diodes are discontinued.
For varactor diode, contact other supplier.

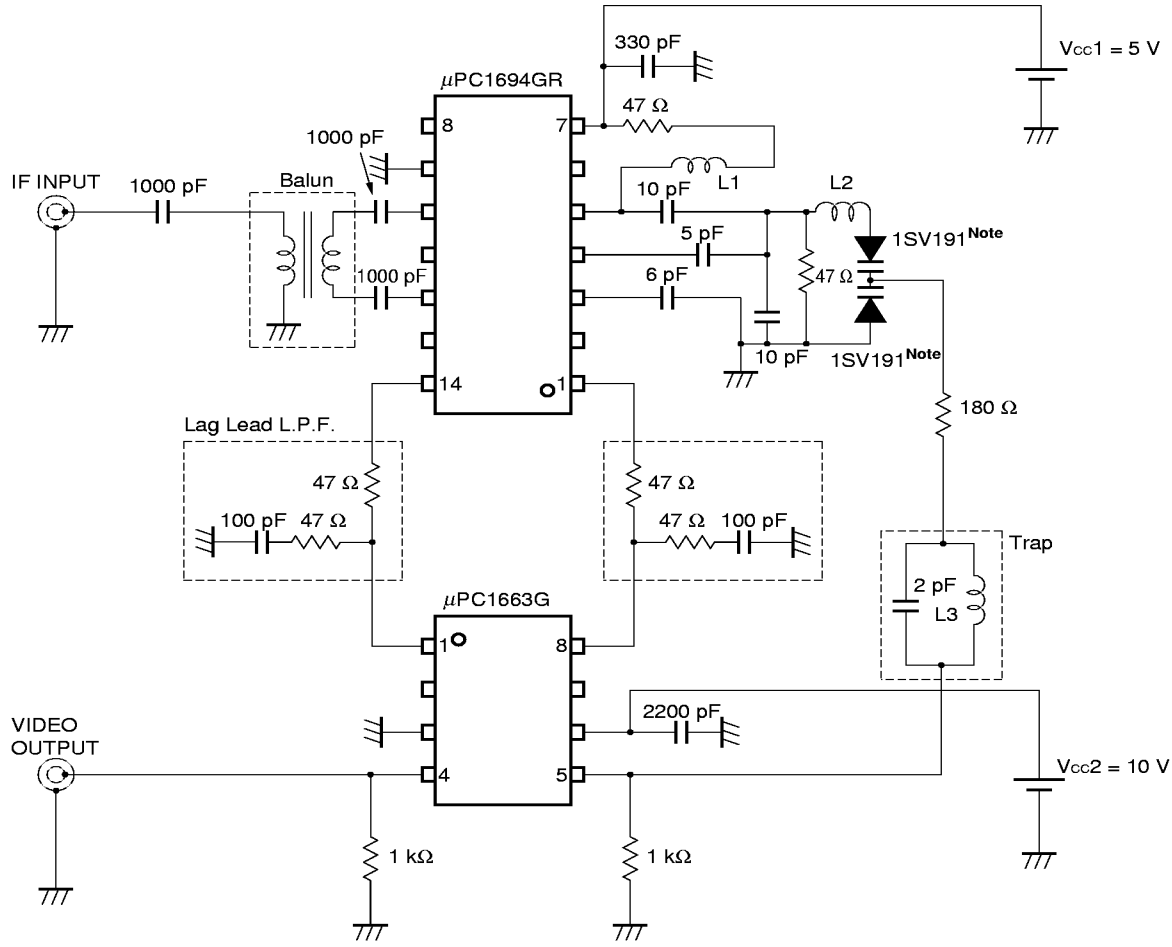
TEST CIRCUIT 3



Note Our varactor diodes are discontinued.
For varactor diode, contact other supplier.

APPLICATION CIRCUIT EXAMPLE 1

For FM demodulator (Example using μPC1694GR and μPC1663G)



L1: Wire diameter: ϕ0.3 mm, Bore: ϕ1.5 mm, Number of turns: 13 T
L2: Wire diameter: ϕ0.4 mm, Bore: ϕ3.5 mm, Number of turns: 2 T
L3: Wire diameter: ϕ0.3 mm, Bore: ϕ1.8 mm, Number of turns: 7 T
Balun: TDK WBT5,5P5-C10129E

Note Our varactor diodes are discontinued.
For varactor diode, contact other supplier.

APPLICATION CIRCUIT EXAMPLE 2

For TV/VCR TUNER

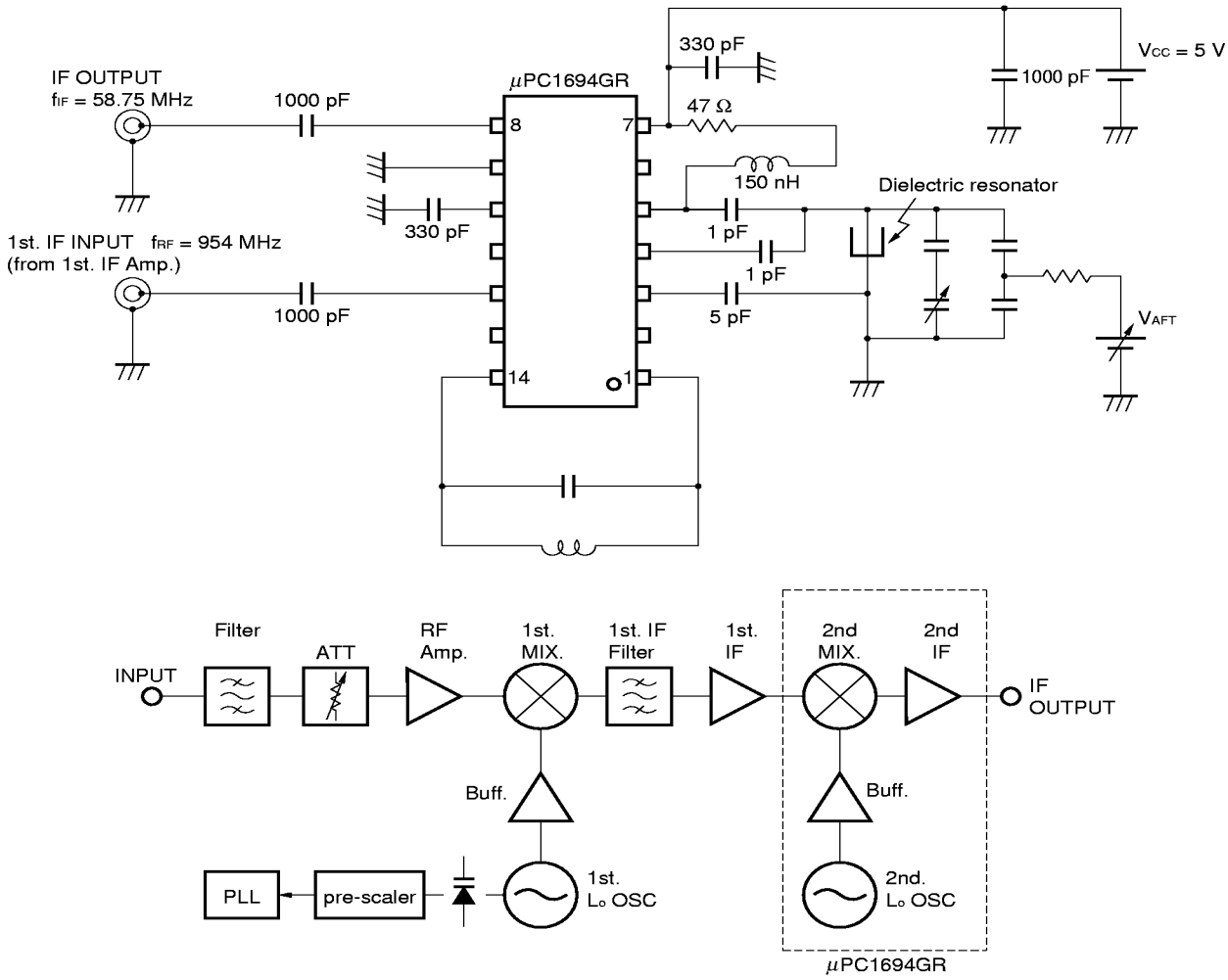
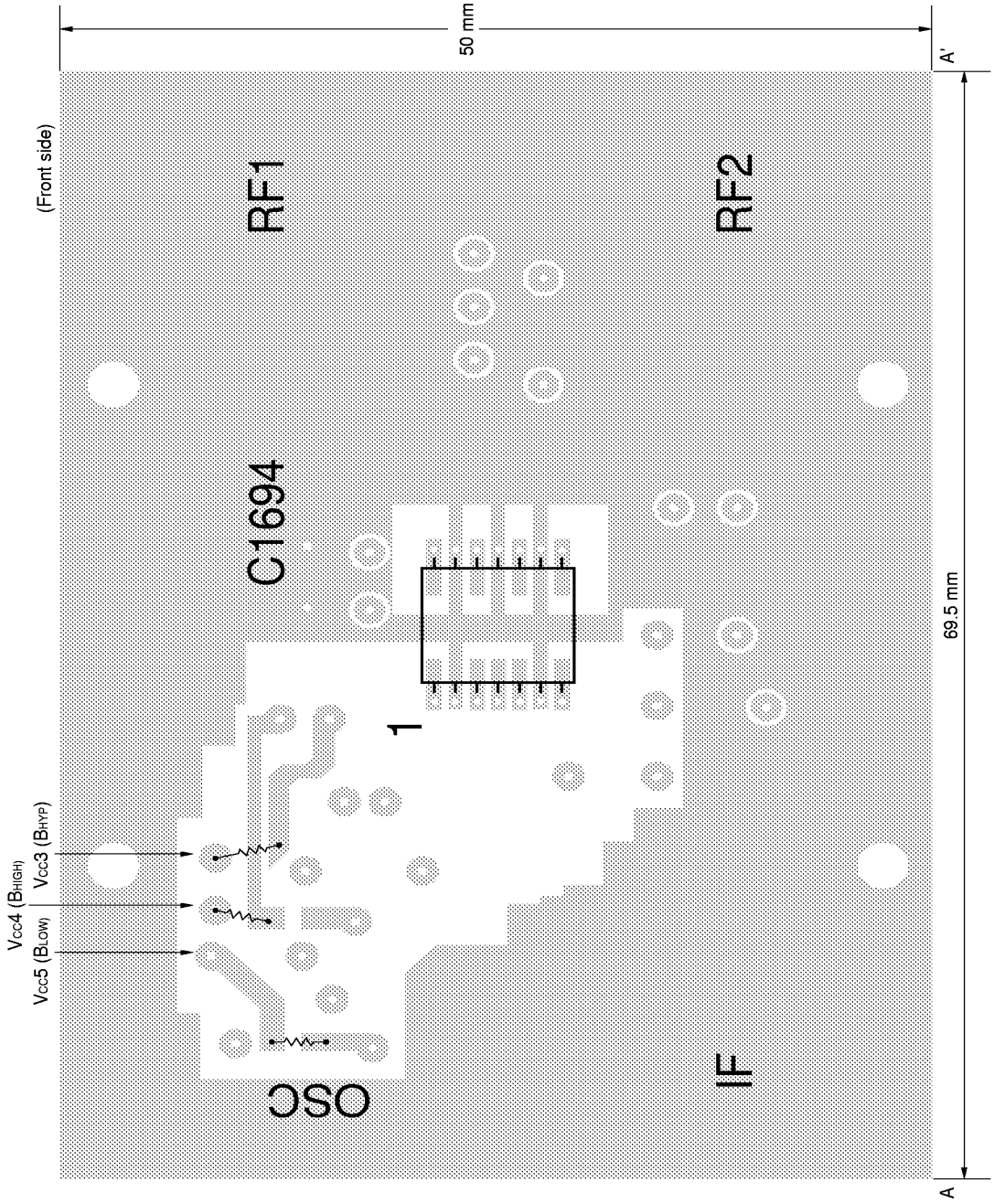


Illustration of The Application Circuit Example 2 Assembled on Evaluation Board



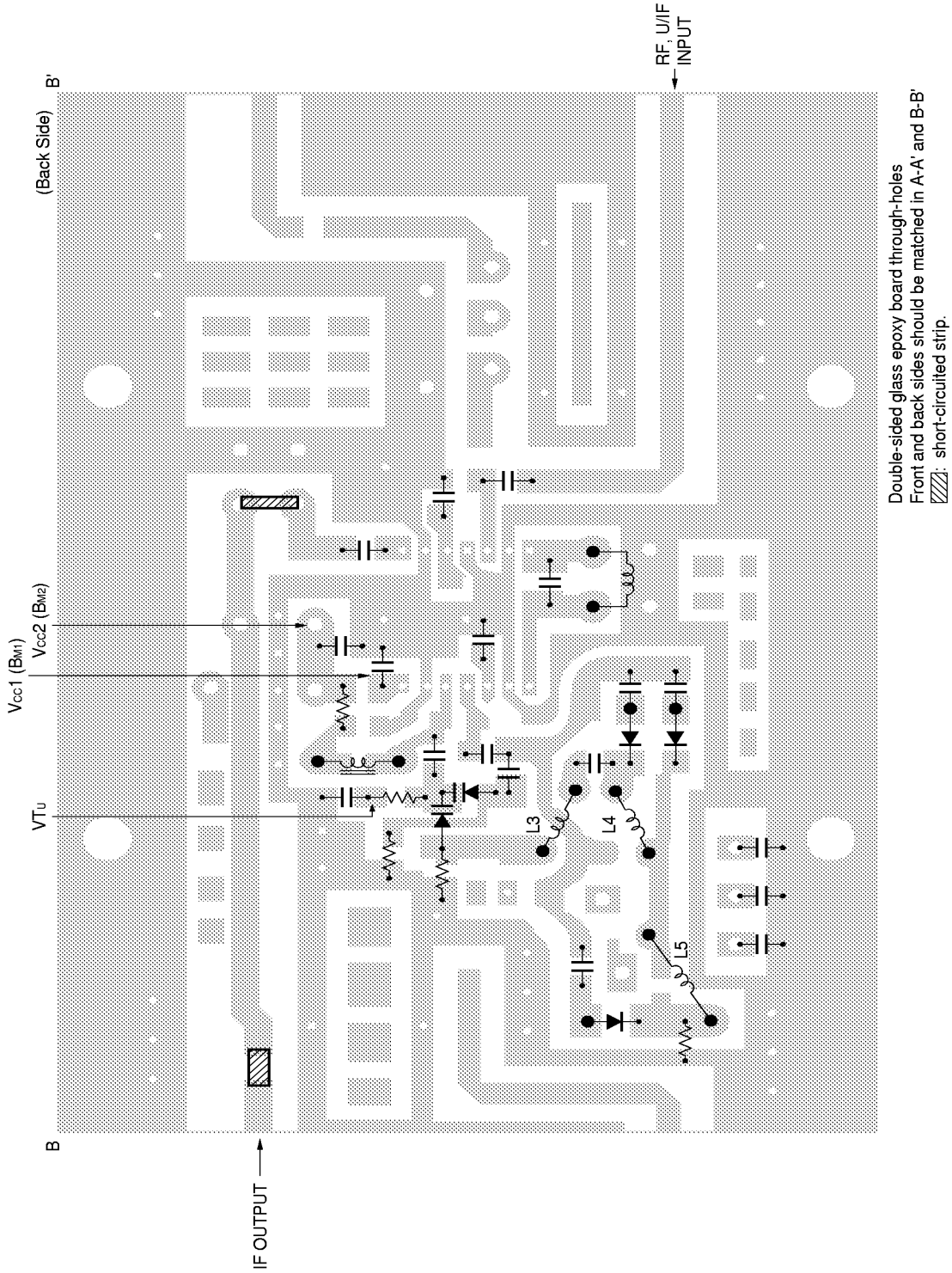
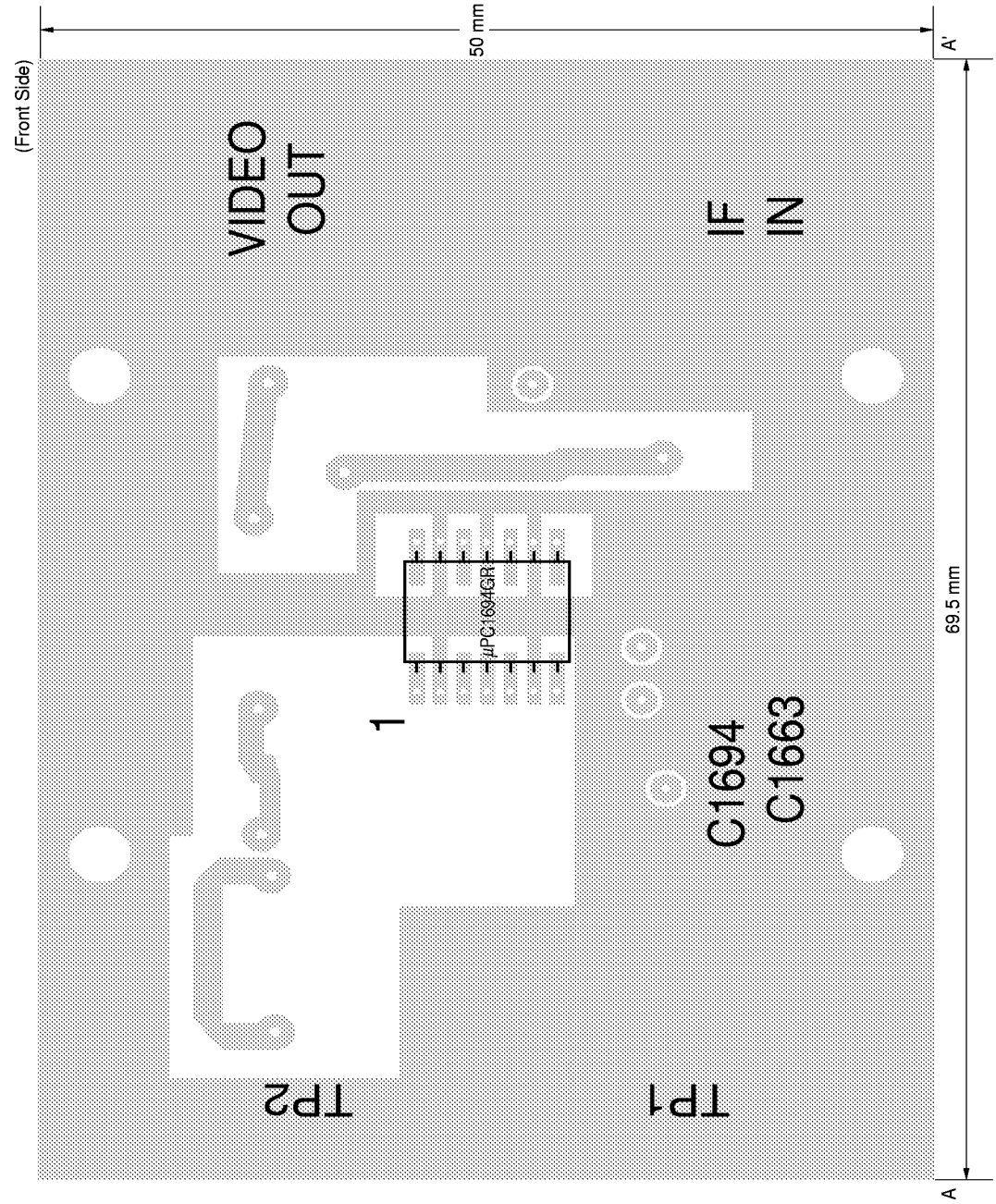
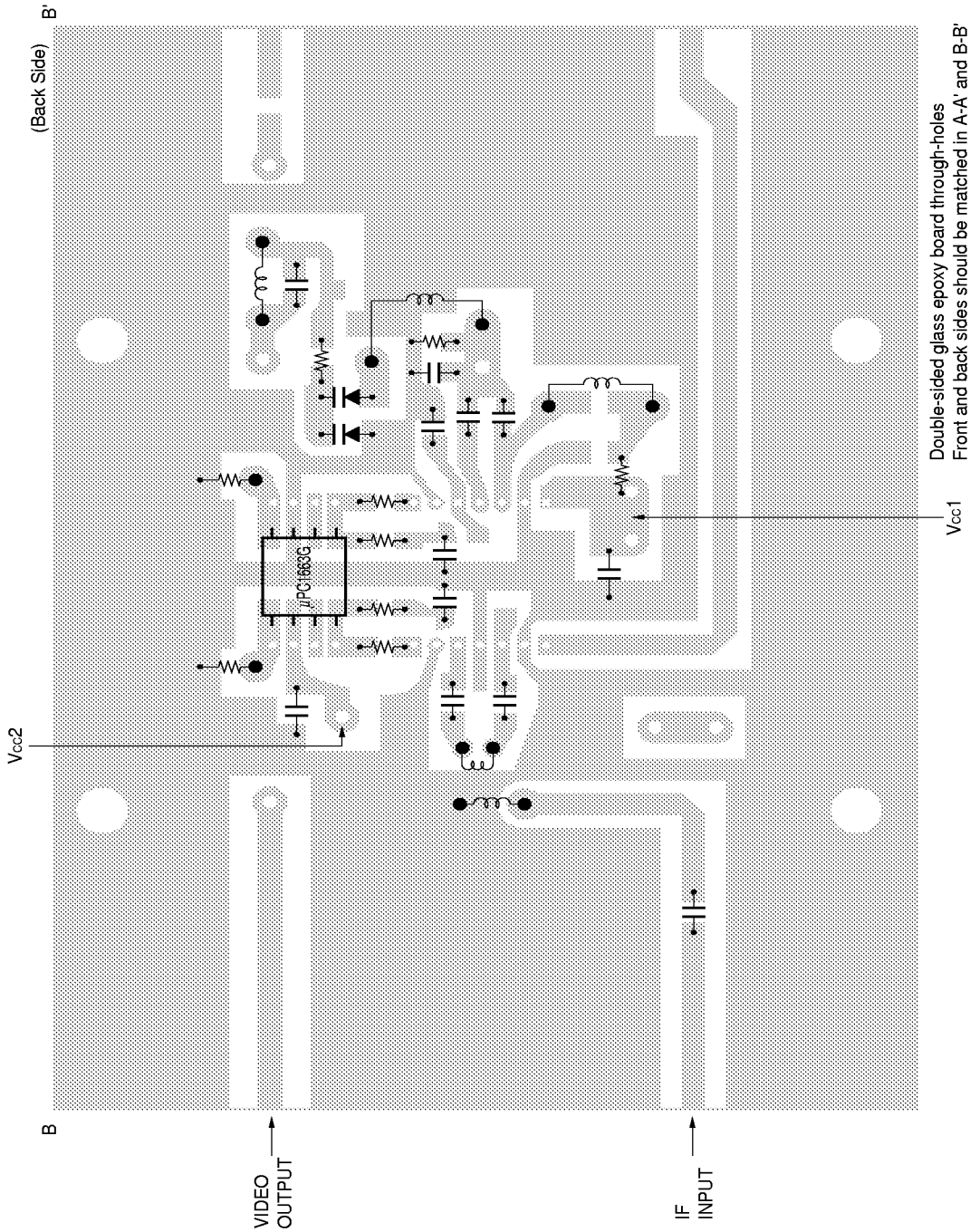


Illustration of The Application Circuit Example 1 Assembled on Evaluation Board

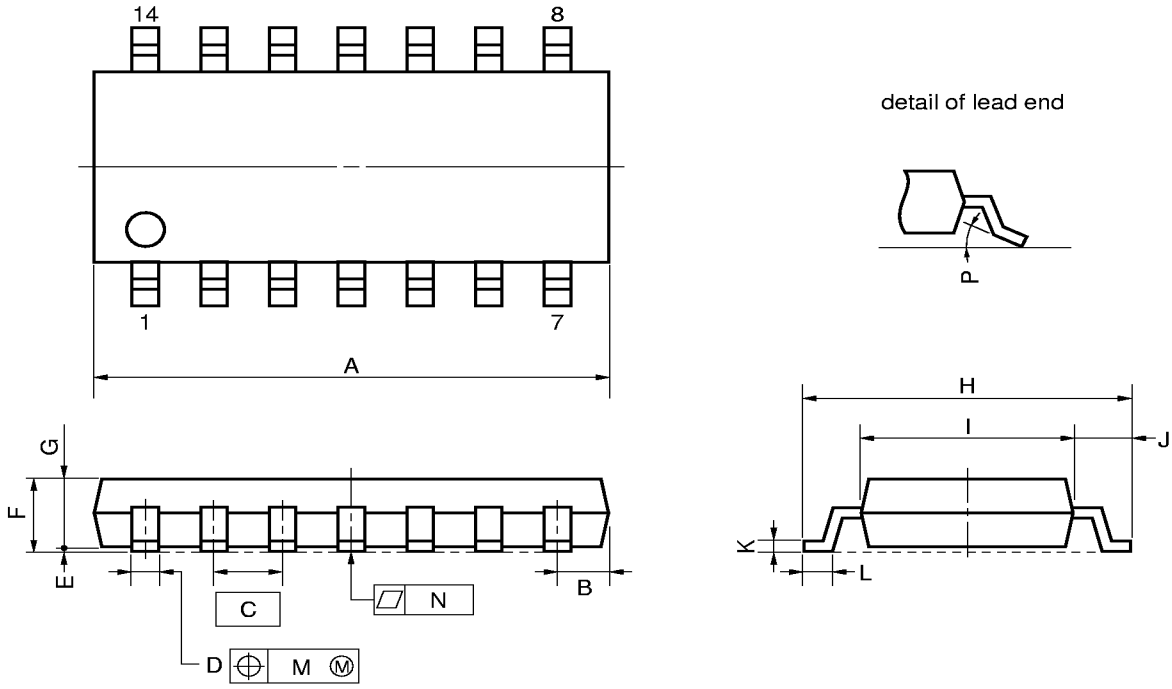




<Notes on Use>

(1) Since this IC uses high frequency process, care is required against the excessive input of static electricity, etc.
(2) Use the shortest possible wiring for the GND pin.
(3) Use the widest possible earth pattern to avoid increase of ground impedance (because it may cause abnormal oscillation).
(4) Insert a bypass capacitor for the V_{CC} pin (e.g., 1 000 pF, 2 200 pF, etc.)
(5) Abnormal oscillation may occur depending on the values of the choke coil and floating capacitance. Therefore, insert a resistor between the power supply and choke coil. (See the application circuit example.)
(6) Suppress the OSC injection level to prevent oscillation from saturating.
Adjust it by inserting a resistor to pin 2 in series. (See the application circuit example.)

14 PIN PLASTIC SOP (225 mil)



NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	10.46 MAX.	0.412 MAX.
B	1.42 MAX.	0.056 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	$0.40^{+0.10}_{-0.05}$	$0.016^{+0.004}_{-0.003}$
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071 MAX.
G	1.49	0.059
H	6.5±0.3	0.256±0.012
I	4.4	0.173
J	1.1	0.043
K	$0.15^{+0.10}_{-0.05}$	$0.006^{+0.004}_{-0.002}$
L	0.6±0.2	$0.024^{+0.008}_{-0.009}$
M	0.12	0.005
N	0.10	0.004
P	$3°^{+7°}_{-3°}$	$3°^{+7°}_{-3°}$

S14GM-50-225B, C-4