

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC1685G

## GENERAL PURPOSE 5 V FREQUENCY DOWN-CONVERTER IC

### DESCRIPTION

The  $\mu$ PC1685G is Silicon monolithic IC designed for UHF band receiver applications. This IC consists of double balanced mixer, local oscillator, IF amplifier, and voltage regulator.

The package is 8-pin SOP suitable for high-density surface mount.

### FEATURES

- UHF band operation
- Good capability of UHF-varactor diode due to balanced amplifier oscillator
- Supply voltage: 5 V
- Packaged in 8-pin SOP suitable for high-density mounting

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### APPLICATIONS

- Tuners for TV and VCR
- Receivers for UHF band

### ORDERING INFORMATION

Part Number	Package	Package Style
$\mu$ PC1685G-E1	8-pin plastic SOP (225 mil)	Embossed tape 12 mm wide. Pin 1 indicates pull-out direction of tape. Qty 2.5 k $\mu$ /reel.

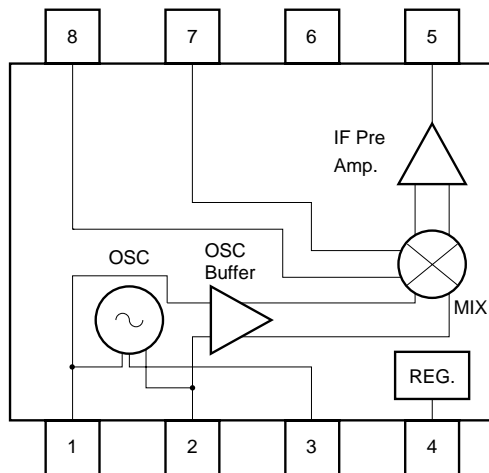
**Remark** To order evaluation samples, please contact your local NEC office. (Part number for sample order:  $\mu$ PC1685G)

**Caution Electro-static sensitive devices**

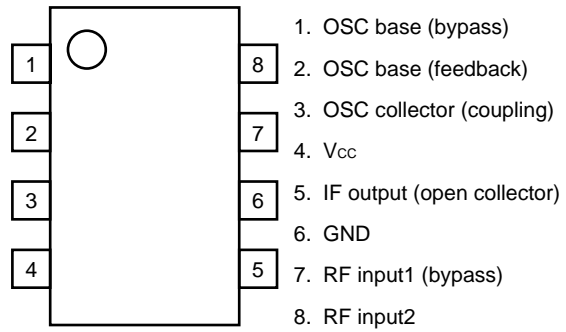
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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

INTERNAL BLOCK DIAGRAM



PIN CONFIGURATION (Top View)



**PIN EXPLANATION**

Pin No.	Symbol	Function and Explanation	Equivalent Circuit
1	OSC base (bypass)	Internal oscillator consists in balance amplifier. 2 pin and 3 pin should be externally equipped with tank resonator circuit in order to oscillate with feedback loop.	
2	OSC base (feedback)	1 pin should be grounded through coupling capacitor to 5 pF.	
3	OSC collector (coupling)	3 pin is defined as open collector. This pin should be coupled through resistor or chock coil in order to adjust Q and be supplied voltage. In case of abnormal oscillation, adjust its Q lower to stabilize the operation.	
4	Vcc	Supply voltage pin for the IC.	
5	IF output	IF output pin. This pin is assigned for the open collector output with high impedance dependent on external inductance.	
6	GND	GND pin for the IC.	
7	RF input 1 (bypass)	7 pin and 8 pin are inputs for mixer designed as double balanced type. Either pin can be assigned for input and another for ground.	
8	RF input 2		

★ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Rating	Unit
Supply Voltage	V <sub>CC</sub>	T <sub>A</sub> = +25 °C	6.0	V
Power Dissipation	P <sub>D</sub>	T <sub>A</sub> = +85 °C <b>Note</b>	250	mW
Operating Ambient Temperature	T <sub>A</sub>		-40 to +85	°C
Storage Temperature	T <sub>stg</sub>		-65 to +150	°C

**Note** Mounted on 50 × 50 × 1.6-mm epoxy glass PWB, with copper patterning on both sides.

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V <sub>CC</sub>	4.5	5.0	5.5	V
Operating Ambient Temperature	T <sub>A</sub>	-40	+25	+85	°C

ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 5 V, T<sub>A</sub> = +25 °C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	I <sub>CC1</sub>	No input signal <b>Note</b>	21	31.5	40	mA
Conversion Gain 1	CG1	f <sub>RF</sub> = 500 MHz, f <sub>IF</sub> = 50 MHz, P <sub>RF</sub> = -40 dBm, P <sub>OSC</sub> = -5 dBm <b>Note</b>	9.5	13.5	15.5	dB
Conversion Gain 2	CG2	f <sub>RF</sub> = 900 MHz, f <sub>IF</sub> = 50 MHz, P <sub>RF</sub> = -40 dBm, P <sub>OSC</sub> = -5 dBm <b>Note</b>	8	12	14	dB
Noise Figure 1	NF1	f <sub>RF</sub> = 500 MHz, f <sub>IF</sub> = 50 MHz, P <sub>OSC</sub> = -5 dBm <b>Note</b>	-	12	15	dB
Noise Figure 2	NF2	f <sub>RF</sub> = 900 MHz, f <sub>IF</sub> = 50 MHz, P <sub>OSC</sub> = -5 dBm <b>Note</b>	-	12.5	15.5	dB
Maximum Output Power 1	P <sub>O(sat)1</sub>	f <sub>RF</sub> = 500 MHz, f <sub>IF</sub> = 50 MHz, P <sub>RF</sub> = 0 dBm, P <sub>OSC</sub> = -5 dBm <b>Note</b>	-	-2	-	dBm
Maximum Output Power 2	P <sub>O(sat)2</sub>	f <sub>RF</sub> = 900 MHz, f <sub>IF</sub> = 50 MHz, P <sub>RF</sub> = 0 dBm, P <sub>OSC</sub> = -5 dBm <b>Note</b>	-	-2	-	dBm

**Note** By test circuit 1

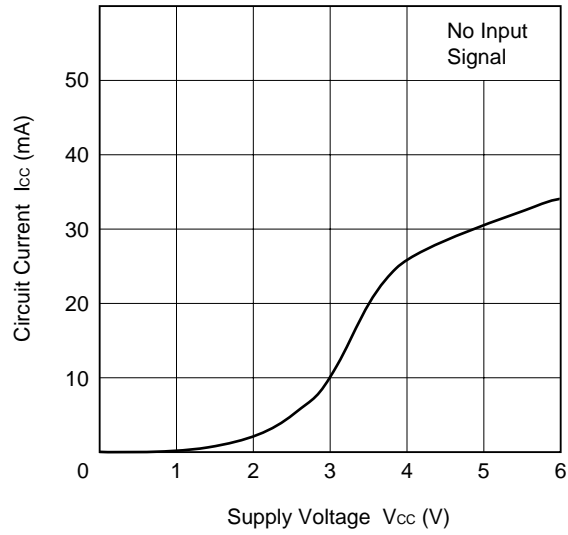
**STANDARD CHARACTERISTICS (FOR REFERENCE) ( $V_{CC} = 5\text{ V}$ ,  $T_A = +25\text{ °C}$  unless otherwise specified)**

Parameter	Symbol	Test Conditions	Reference Values	Unit
Oscillation Frequency Stability	$f_{stb}$	$V_{CC} = \pm 10\%$ , $f_{osc} = 550\text{ to }950\text{ MHz}$ <b>Note 1</b>	$\pm 200$	kHz
Oscillation Frequency Drift	$f_{drift}$	$f_{osc} = 550\text{ to }950\text{ MHz}$ , 30 min. <b>Note 1</b>	150	kHz
Oscillation Start Voltage	$V_{osc}$	$f_{osc} = 550\text{ to }950\text{ MHz}$ <b>Note 1</b>	3.0	V
1 % Cross-modulation Distortion 1	CM1	$f_{RF} = 500\text{ MHz}$ <b>Note 2, 3</b>	86.5	$\text{dB}\mu$
1 % Cross-modulation Distortion 2	CM2	$f_{RF} = 900\text{ MHz}$ <b>Note 2, 3</b>	86	$\text{dB}\mu$

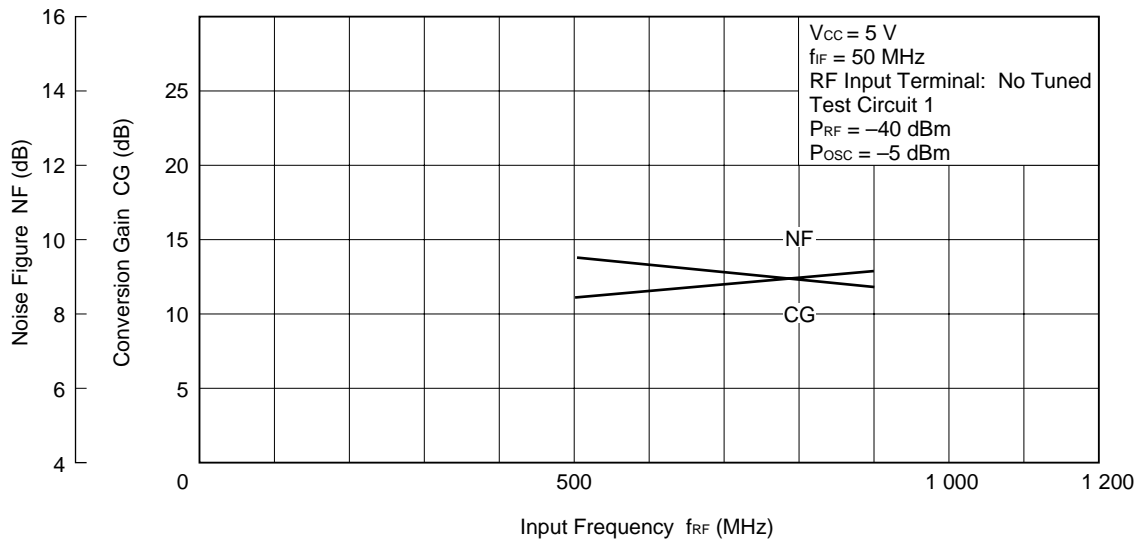
- Notes**
1. By test circuit 2
  2. By test circuit 1
  3.  $f_{undes} = f_{RF} \pm 12\text{ MHz}$ ,  $PRF = -31\text{ dBm}$ ,  $f_{IF} = 50\text{ MHz}$ ,  $P_{osc} = -5\text{ dBm}$   
 AM: 100 kHz, 30 % Mod., S/I Ratio = 46 dBc, output 75  $\Omega$  open

TYPICAL CHARACTERISTICS ( $T_A = +25\text{ }^\circ\text{C}$ )

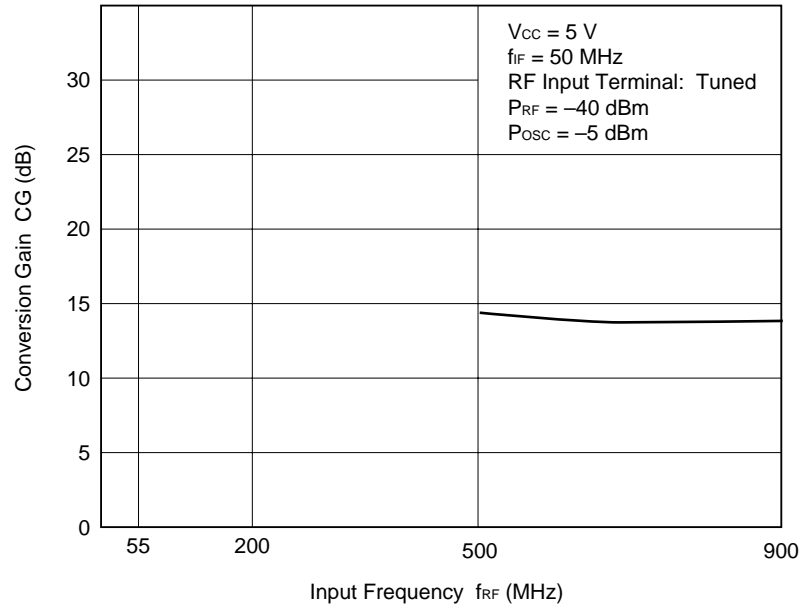
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



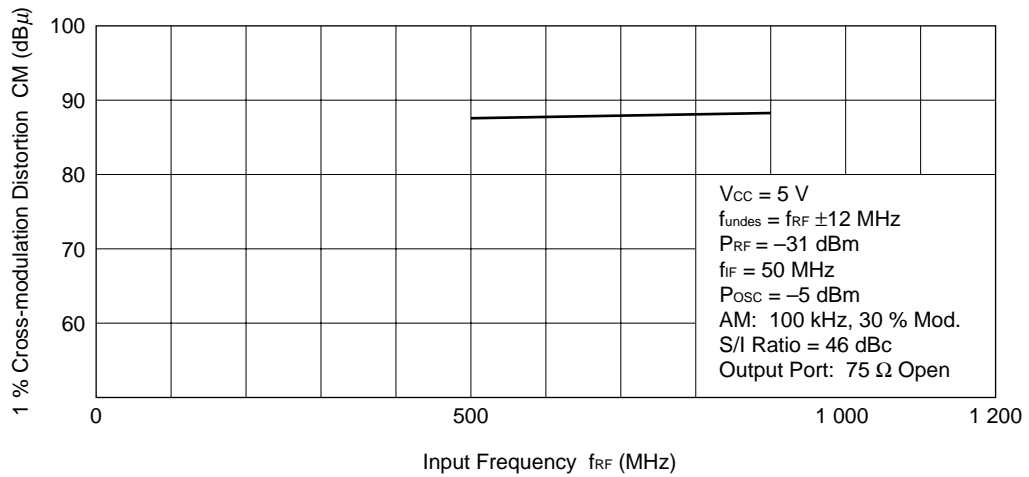
NOISE FIGURE AND CONVERSION GAIN vs. INPUT FREQUENCY



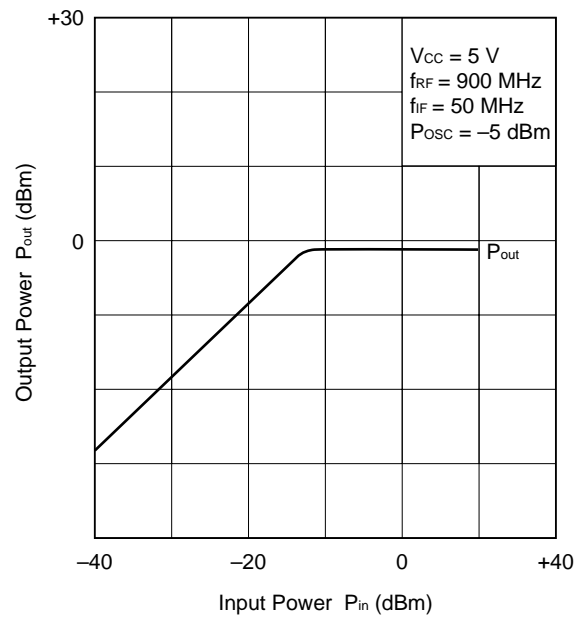
CONVERSION GAIN vs. INPUT FREQUENCY



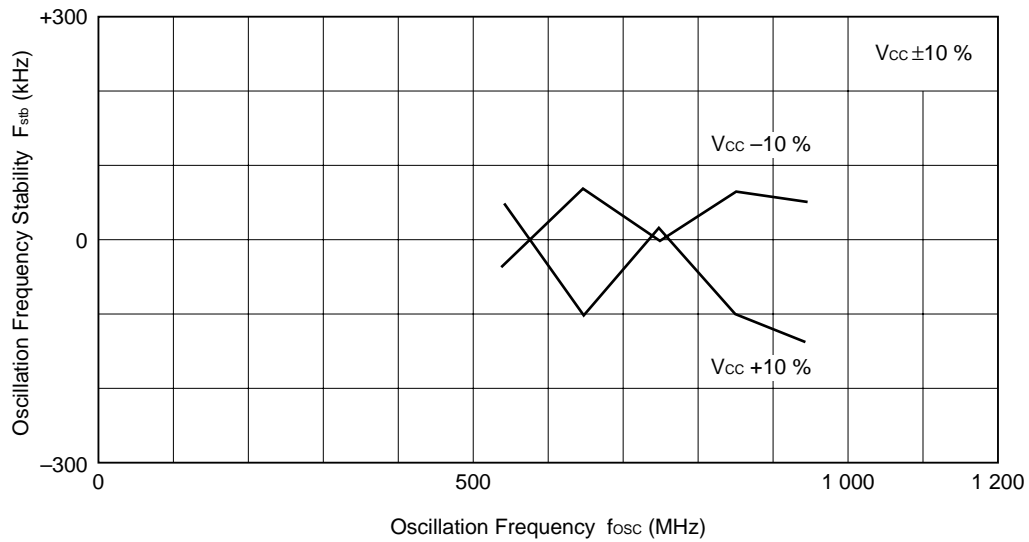
1 % CROSS-MODULATION DISTORTION vs. INPUT FREQUENCY



OUTPUT POWER vs. INPUT POWER

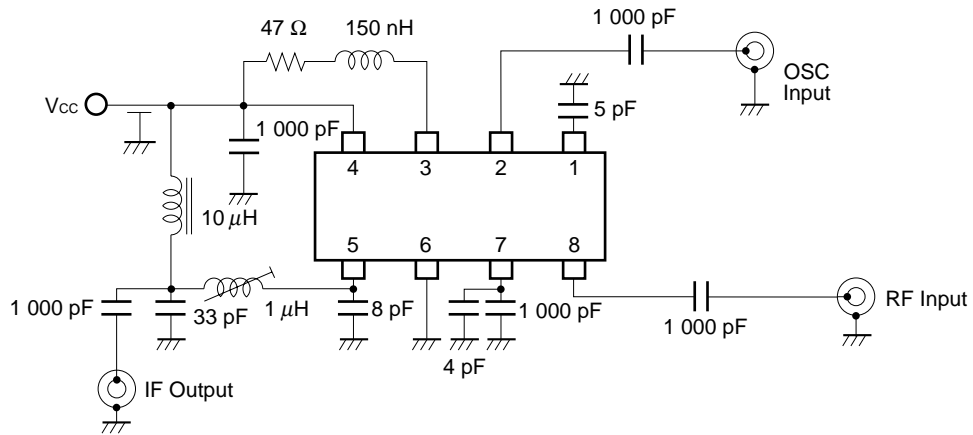


OSC-FREQUENCY STABILITY vs. OSC-FREQUENCY

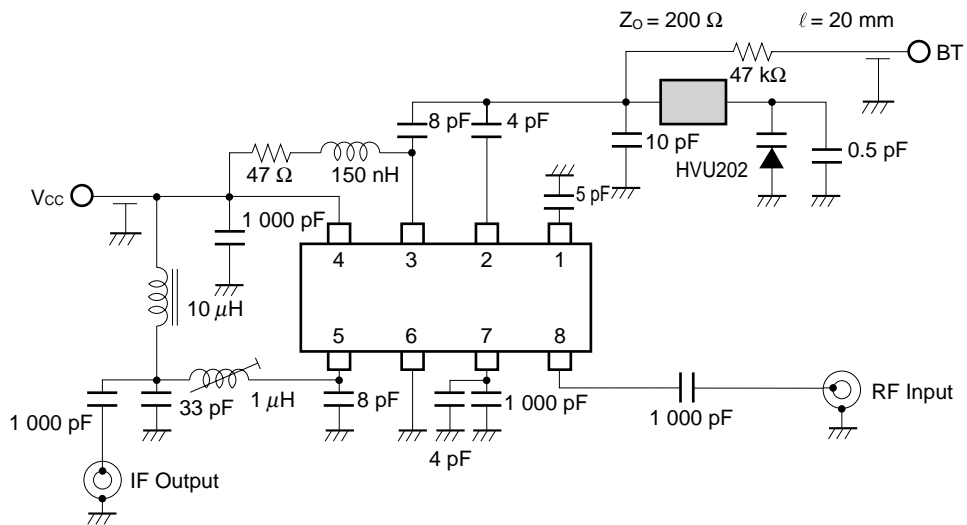




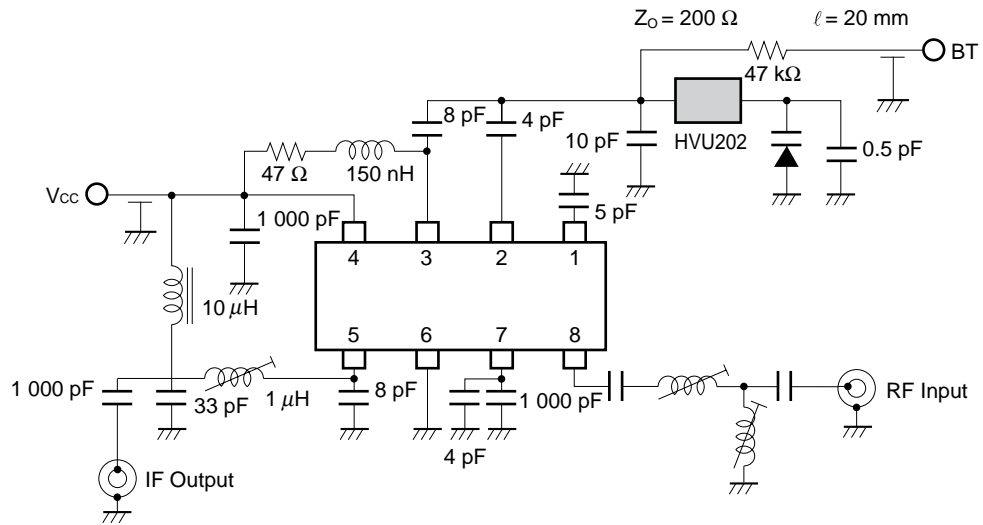
TEST CIRCUIT 1



TEST CIRCUIT 2

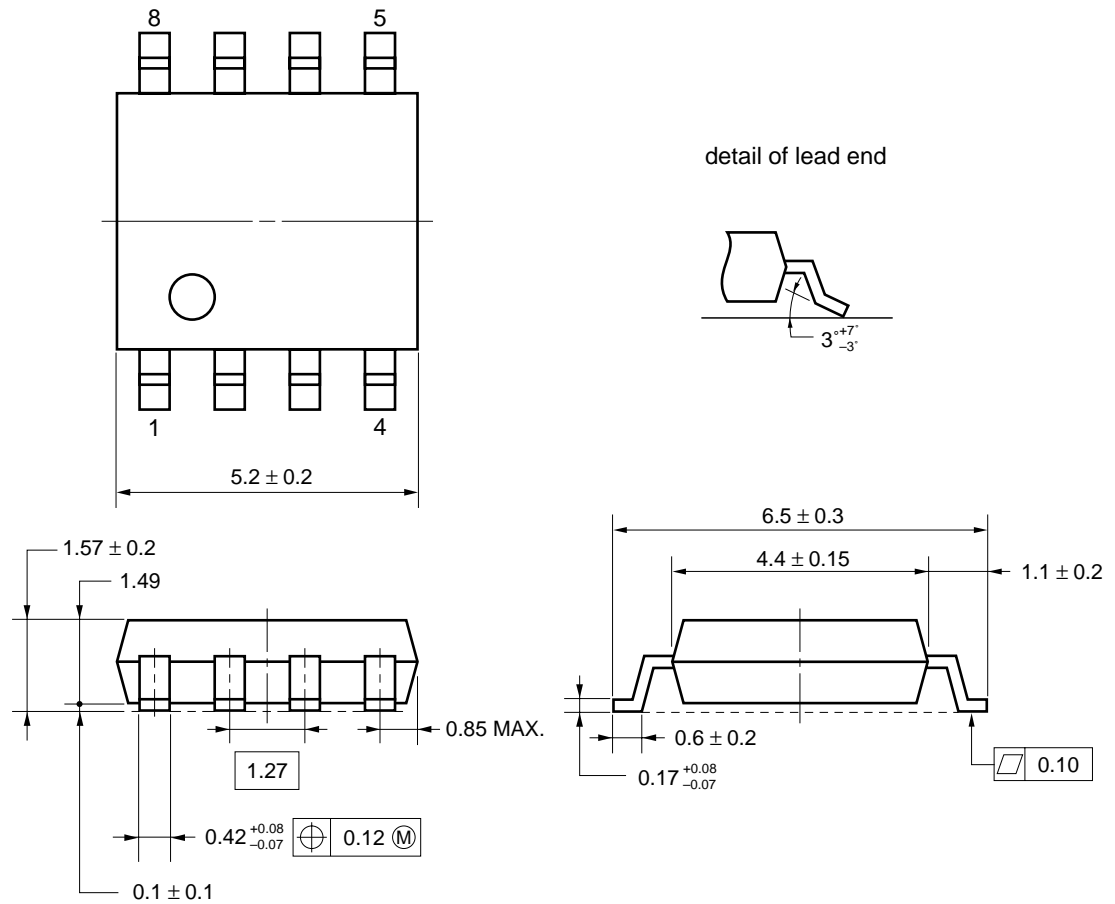


APPLICATION CIRCUIT EXAMPLE



★ PACKAGE DIMENSIONS

8 PIN PLASTIC SOP (225 mil) (UNIT: mm)



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

**NOTE ON CORRECT USE**

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesired oscillation).
- (3) Keep the track length of the ground pins as short as possible.
- (4) Connect a bypass capacitor (example: 1 000 pF) to the Vcc pin.

**RECOMMENDED SOLDERING CONDITIONS**

This product should be soldered under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your NEC sales representative.

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared Reflow	Package peak temperature: 235 °C or below Time: 30 seconds or less (at 210 °C) Count: 3, Exposure limit: None <sup>Note</sup>	IR35-00-3
VPS	Package peak temperature: 215 °C or below Time: 40 seconds or less (at 200 °C) Count: 3, Exposure limit: None <sup>Note</sup>	VP15-00-3
Wave Soldering	Soldering bath temperature: 260 °C or below Time: 10 seconds or less Count: 1, Exposure limit: None <sup>Note</sup>	WS60-00-1
Partial Heating	Pin temperature: 300 °C Time: 3 seconds or less (per side of device) Exposure limit: None <sup>Note</sup>	—

**Note** After opening the dry pack, keep it in a place below 25 °C and 65 % RH for the allowable storage period.

**Caution** Do not use different soldering methods together (except for partial heating).

For details of recommended soldering conditions for surface mounting, refer to information document SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E).

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