NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1685G

GENERAL PURPOSE 5 V FREQUENCY DOWN-CONVERTER IC

DESCRIPTION

The μPC1685G 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

★ APPLICATIONS

- Tuners for TV and VCR
- Receivers for UHF band

ORDERING INFORMATION

Part Number	Package	Package Style
μPC1685G-E1	8-pin plastic SOP (225 mil)	Embossed tape 12 mm wide. Pin 1 indicates pull-out direction of tape. Qty 2.5 kp/reel.

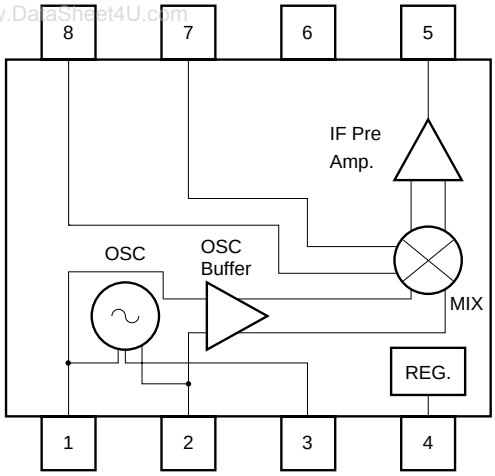
Remark To order evaluation samples, please contact your local NEC office. (Part number for sample order: μPC1685G)

Caution Electro-static sensitive devices

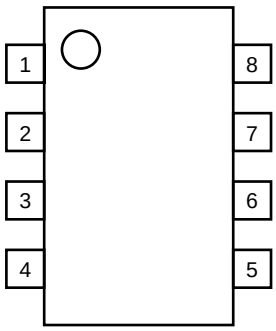
Document No. P14483EJ2V0DS00 (2nd edition)
(Previous No. ID-2330)
Date Published October 1999 N CP(K)
Printed in Japan

The mark ★ shows major revised points.

INTERNAL BLOCK DIAGRAM

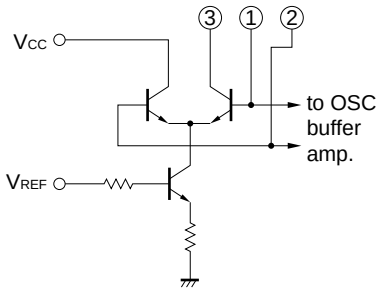
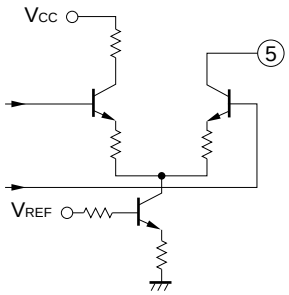
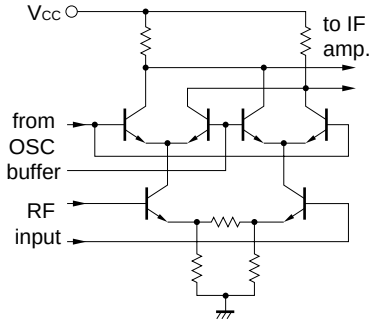


PIN CONFIGURATION (Top View)



1. OSC base (bypass)
2. OSC base (feedback)
3. OSC collector (coupling)
4. V_{CC}
5. IF output (open collector)
6. GND
7. RF input1 (bypass)
8. RF input2

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 equiped with tank resonater circuit in order to oscillate with feedback loop.	
2	OSC base (feedback)	1 pin should be grounded through coupling capacitor to 5 pF. 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.	
3	OSC collector (coupling)		
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_{CC}	T_A = +25 °C	6.0	V
Power Dissipation	P_D	T_A = +85 °C **Note**	250	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–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_{CC}	4.5	5.0	5.5	V
Operating Ambient Temperature	T_A	–40	+25	+85	°C

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

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	$I_{CC}1$	No input signal **Note**	21	31.5	40	mA
Conversion Gain 1	CG1	f_{RF} = 500 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm, P_{OSC} = –5 dBm **Note**	9.5	13.5	15.5	dB
Conversion Gain 2	CG2	f_{RF} = 900 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm, P_{OSC} = –5 dBm **Note**	8	12	14	dB
Noise Figure 1	NF1	f_{RF} = 500 MHz, f_{IF} = 50 MHz, P_{OSC} = –5 dBm **Note**	–	12	15	dB
Noise Figure 2	NF2	f_{RF} = 900 MHz, f_{IF} = 50 MHz, P_{OSC} = –5 dBm **Note**	–	12.5	15.5	dB
Maximum Output Power 1	$P_{O(sat)}1$	f_{RF} = 500 MHz, f_{IF} = 50 MHz, P_{RF} = 0 dBm, P_{OSC} = –5 dBm **Note**	–	–2	–	dBm
Maximum Output Power 2	$P_{O(sat)}2$	f_{RF} = 900 MHz, f_{IF} = 50 MHz, P_{RF} = 0 dBm, P_{OSC} = –5 dBm **Note**	–	–2	–	dBm

Note By test circuit 1

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

Parameter	Symbol	Test Conditions	Reference Values	Unit
Oscillation Frequency Stability	f_{stb}	V_{CC} = ±10 %, f_{OSC} = 550 to 950 MHz **Note 1**	±200	kHz
Oscillation Frequency Drift	f_{drift}	f_{OSC} = 550 to 950 MHz, 30 min. **Note 1**	150	kHz
Oscillation Start Voltage	V_{OSC}	f_{OSC} = 550 to 950 MHz **Note 1**	3.0	V
1 % Cross-modulation Distortion 1	CM1	f_{RF} = 500 MHz **Note 2, 3**	86.5	dBμ
1 % Cross-modulation Distortion 2	CM2	f_{RF} = 900 MHz **Note 2, 3**	86	dBμ

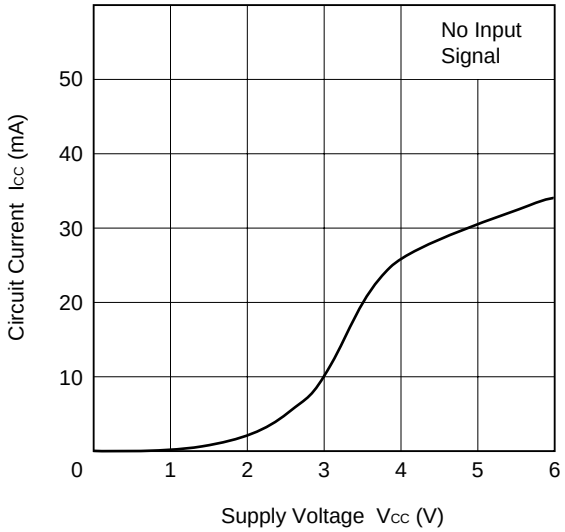
Notes 1. By test circuit 2

2. By test circuit 1

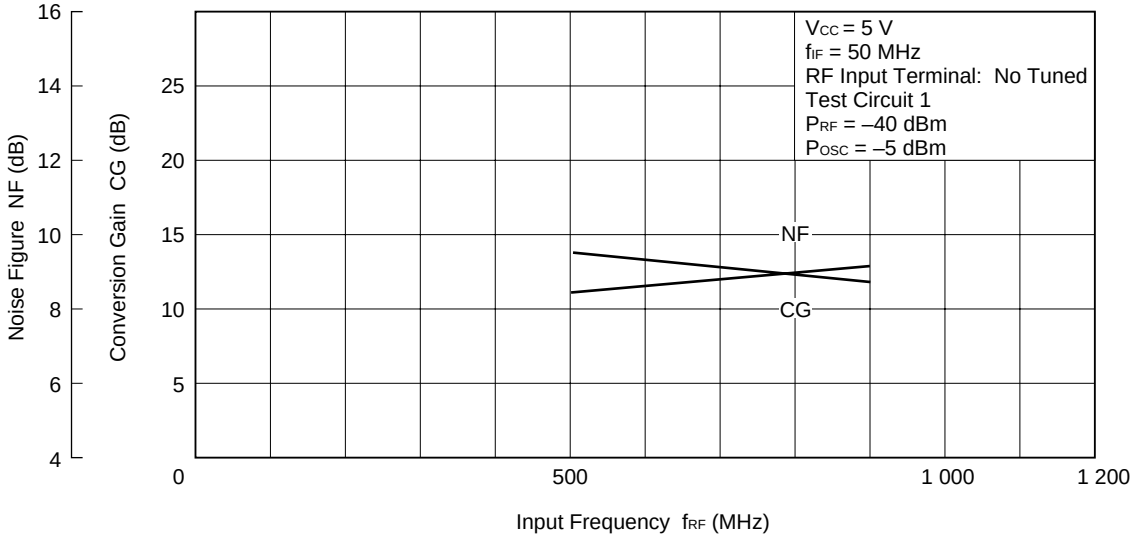
3. f_{undes} = f_{RF} ±12 MHz, P_{RF} = –31 dBm, f_{IF} = 50 MHz, P_{OSC} = –5 dBm
AM: 100 kHz, 30 % Mod., S/I Ratio = 46 dBc, output 75 Ω open

TYPICAL CHARACTERISTICS (T_A = +25 °C)

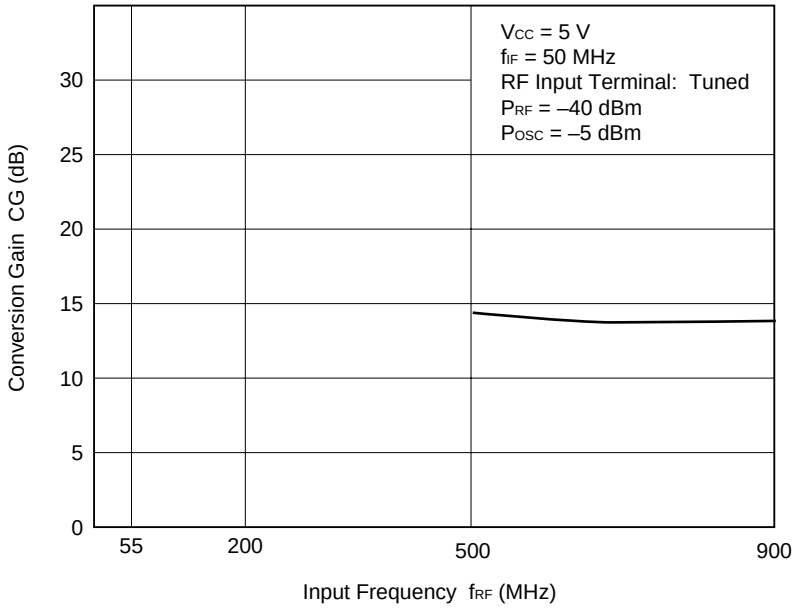
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



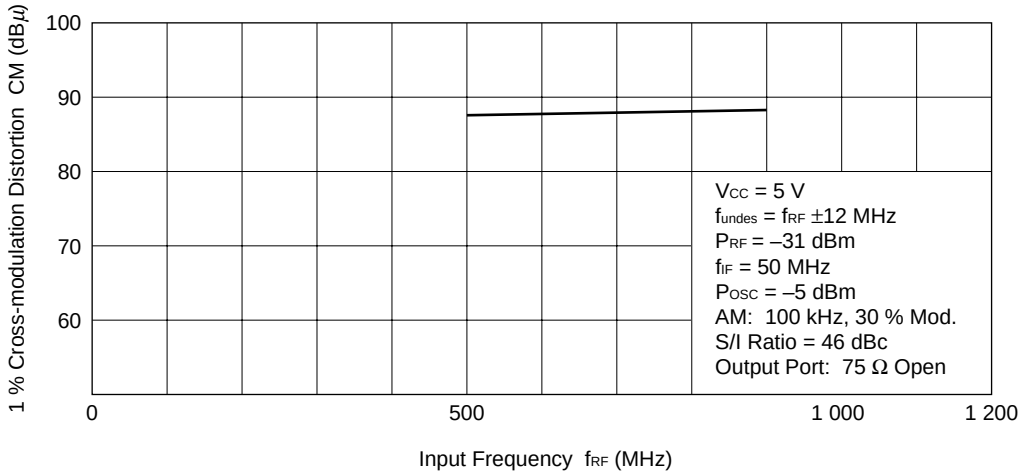
NOISE FIGURE AND CONVERSION GAIN vs. INPUT FREQUENCY



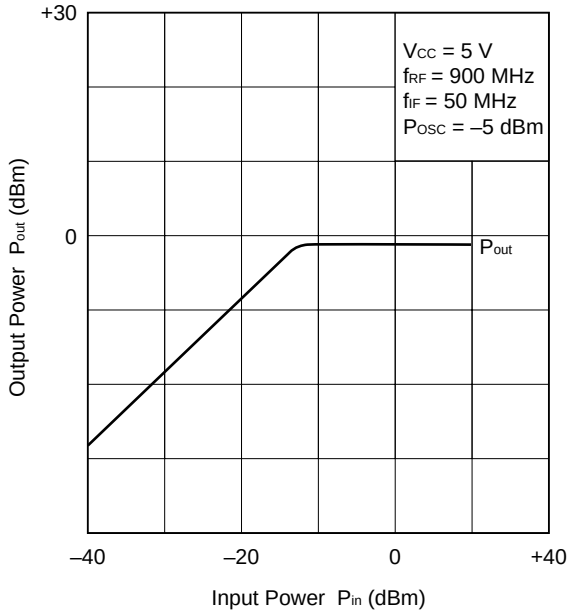
CONVERSION GAIN vs. INPUT FREQUENCY



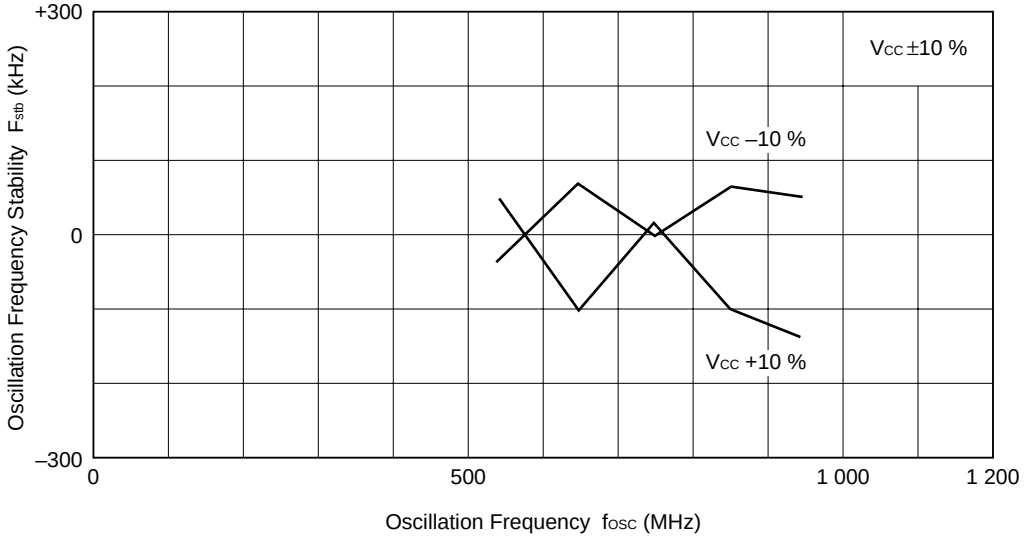
1 % CROSS-MODULATION DISTORTION vs. INPUT FREQUENCY



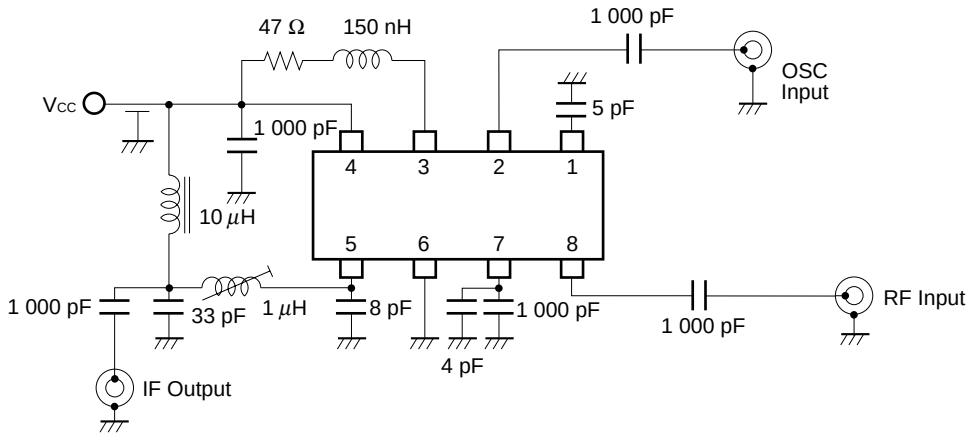
OUTPUT POWER vs. INPUT POWER



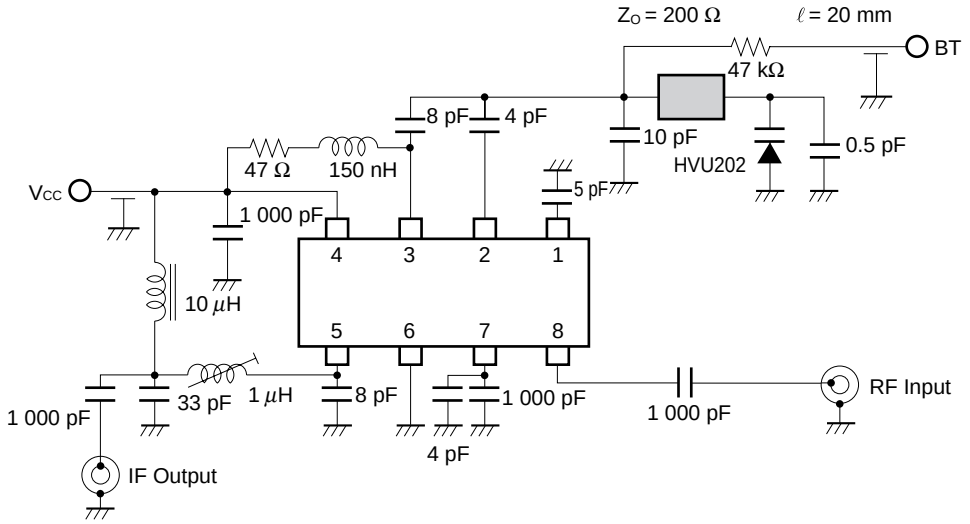
OSC-FREQUENCY STABILITY vs. OSC-FREQUENCY



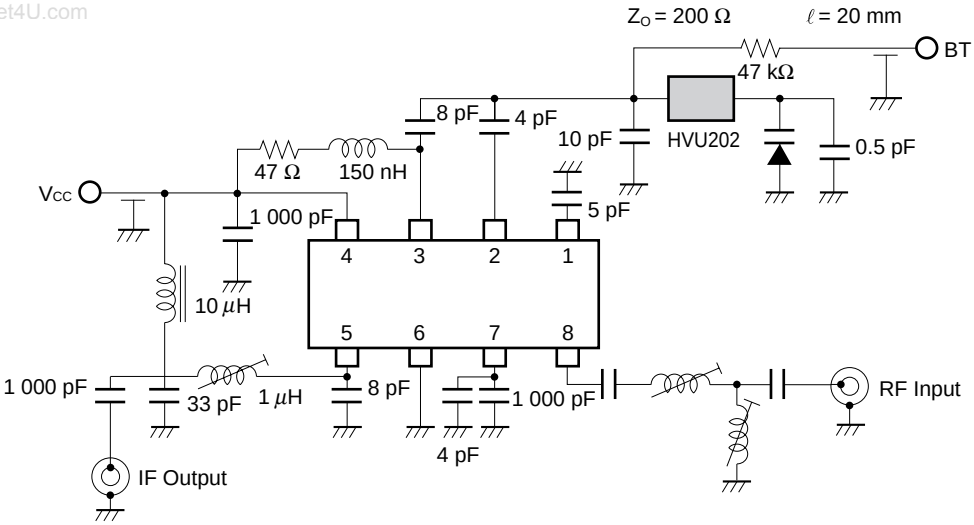
TEST CIRCUIT 1



TEST CIRCUIT 2

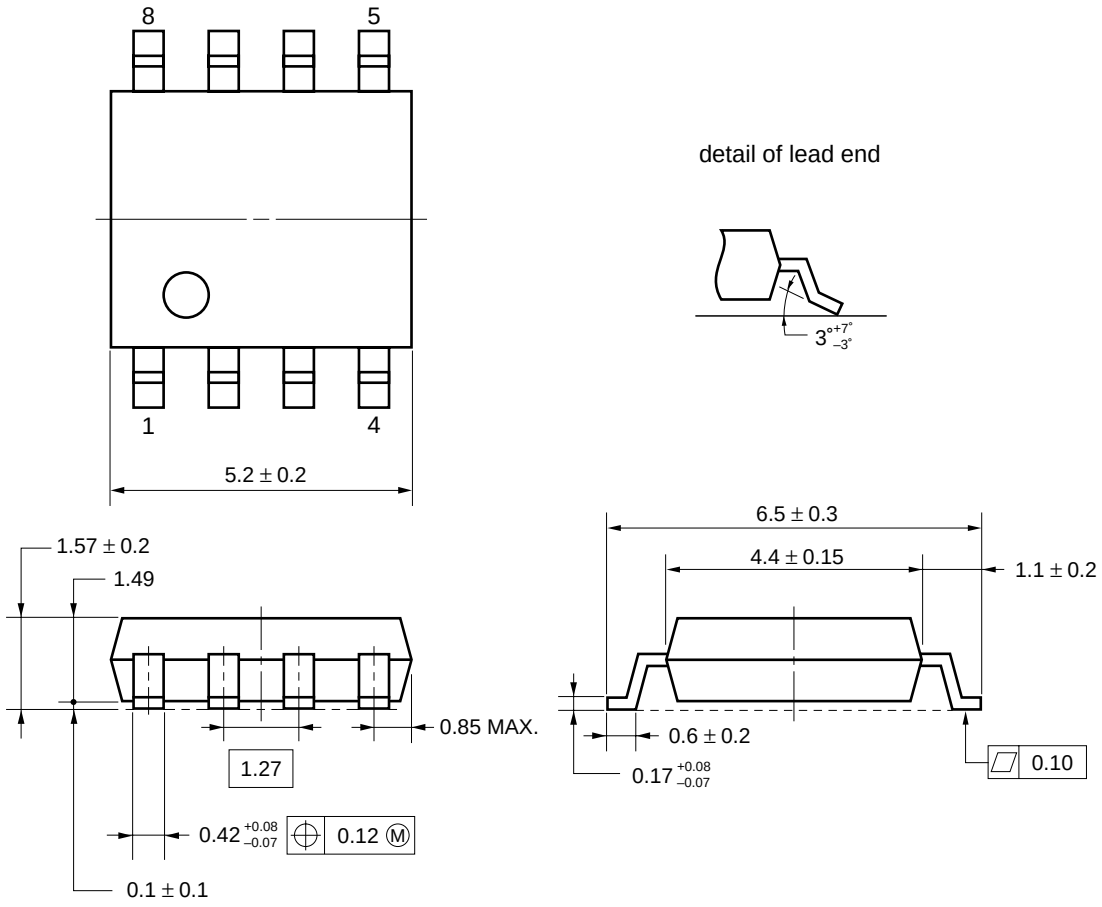


APPLICATION CIRCUIT EXAMPLE



★ 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 V_{CC} 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[Note]	IR35-00-3
VPS	Package peak temperature: 215 °C or below Time: 40 seconds or less (at 200 °C) Count: 3, Exposure limit: None[Note]	VP15-00-3
Wave Soldering	Soldering bath temperature: 260 °C or below Time: 10 seconds or less Count: 1, Exposure limit: None[Note]	WS60-00-1
Partial Heating	Pin temperature: 300 °C Time: 3 seconds or less (per side of device) Exposure limit: None[Note]	–

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).

[MEMO]

[MEMO]

[MEMO]

NESAT (NEC Silicon Advanced Technology) is a trademark of NEC Corporation.

- **The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.**
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.
- NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.
- Descriptions of circuits, software, and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software, and information in the design of the customer's equipment shall be done under the full responsibility of the customer. NEC Corporation assumes no responsibility for any losses incurred by the customer or third parties arising from the use of these circuits, software, and information.
- While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.
- NEC devices are classified into the following three quality grades:
  "Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.
  - Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
  - Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
  - Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

  The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

M7 98.8