NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC1686G/GV

GENERAL PURPOSE 5 V FREQUENCY DOWN-CONVERTER IC

DESCRIPTION

The μPC1686 is Silicon monolithic IC designed for VHF band receiver applications. This IC consists of double balanced mixer, local oscillator, IF amplifier, and voltage regulator.

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

FEATURES

- VHF/CATV band operation
- Single-end push-pull IF amplifier suppresses fluctuation in output impedance.
- Good capability of VHF-varactor diode due to balanced amplifier oscillator
- Supply voltage: 5 V
- Packaged in 8-pin SOP or SSOP suitable for high-density mounting

★ APPLICATIONS

- Tuners for TV and VCR
- Receivers for VHF band

ORDERING INFORMATION

Part Number	Package	Supplying Form
μPC1686G-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.
μPC1686GV-E1	8-pin plastic SSOP (175 mil)	Embossed tape 8 mm wide. Pin 1 indicates pull-out direction of tape. Qty 1 kp/reel.

Remark To order evaluation samples, please contact your local NEC office. (Part number for sample order: μPC1686G, μPC1686GV)

Caution Electro-static sensitive devices

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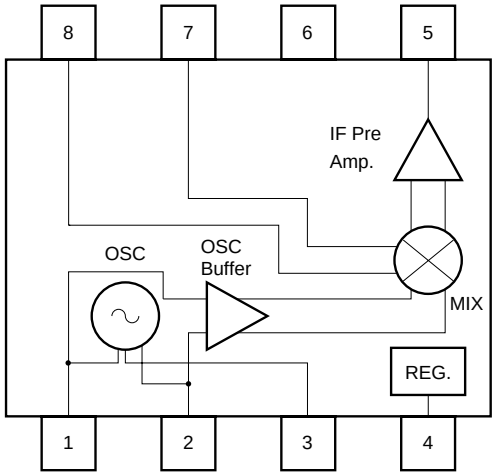
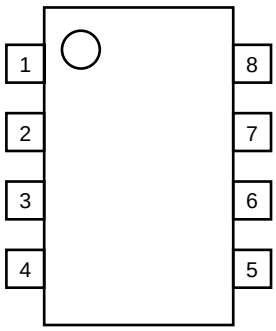
The mark ★ shows major revised points.

INTERNAL BLOCK DIAGRAM

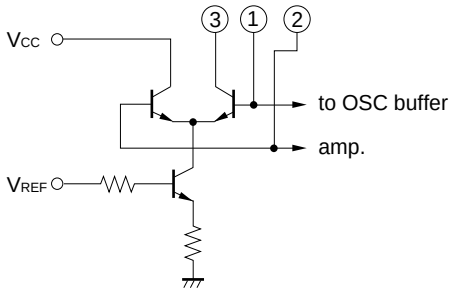
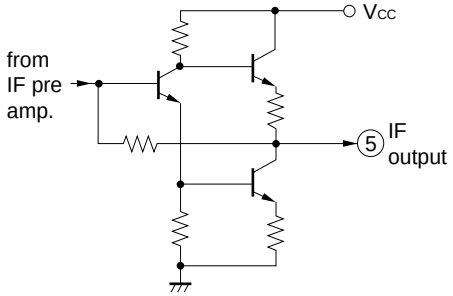
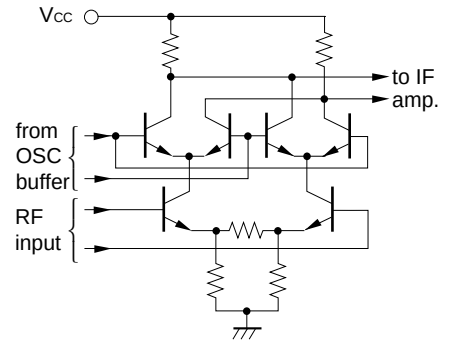


PIN CONFIGURATION (Top View)



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 approximate 10 pF coupling capacitor.	
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	V_{CC}	Supply voltage pin for the IC.	
5	IF output	IF output pin. IF amplifier is designed as single-end push-pull amplifier. This pin is assigned for the emitter follower output with 50 Ω constant resistive impedance in wide band.	
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	Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	$I_{CC}1$	no input signal **Note**	25	38	48	mA
Conversion Gain 1	CG1	f_{RF} = 55 MHz, f_{IF} = 44 MHz, P_{RF} = –40 dBm, P_{OSC} = –5 dBm **Note**	15	19	22	dB
Conversion Gain 2	CG2	f_{RF} = 200 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm, P_{OSC} = –5 dBm **Note**	15.5	19.5	22.5	dB
Conversion Gain 3	CG3	f_{RF} = 440 MHz, f_{IF} = 50 MHz, P_{RF} = –40 dBm, P_{OSC} = –5 dBm **Note**	16	20	23	dB
Noise Figure 1	NF1	f_{RF} = 55 MHz, f_{IF} = 44 MHz, P_{OSC} = –5 dBm **Note**	–	11	14	dB
Noise Figure 2	NF2	f_{RF} = 200 MHz, f_{IF} = 50 MHz P_{OSC} = –5 dBm **Note**	–	11	14	dB
Noise Figure 3	NF3	f_{RF} = 440 MHz, f_{IF} = 50 MHz, P_{OSC} = –5 dBm **Note**	–	12	15	dB
Maximum Output Power 1	$P_{O(sat)}1$	f_{RF} = 55 MHz, f_{IF} = 44 MHz, P_{RF} = 0 dBm, P_{OSC} = –5 dBm **Note**	–	+10	–	dBm
Maximum Output Power 2	$P_{O(sat)}2$	f_{RF} = 200 MHz, f_{IF} = 50 MHz, P_{RF} = 0 dBm, P_{OSC} = –5 dBm **Note**	–	+10	–	dBm
Maximum Output Power 3	$P_{O(sat)}3$	f_{RF} = 440 MHz, f_{IF} = 50 MHz, P_{RF} = 0 dBm, P_{OSC} = –5 dBm **Note**	–	+10	–	dBm

Note By test circuit 1

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

Parameter	Symbol	Conditions	Reference Values	Unit
Oscillation Frequency Stability	f_{stb}	V_{CC} = ±10 %, f_{OSC} = 100 to 490 MHz **Note 1**	±100	kHz
Oscillation Frequency Drift	f_{drift}	f_{OSC} = 100 to 490 MHz, 30 min **Note 1**	100	kHz
Oscillation Start Voltage	V_{OSC}	f_{OSC} = 100 to 490 MHz **Note 1**	3.0	V
1 % Cross-modulation Distortion 1	CM1	f_{RF} = 55 MHz, f_{IF} = 44 MHz **Note 2, 3**	94	dBμ
1 % Cross-modulation Distortion 2	CM2	f_{RF} = 200 MHz, f_{IF} = 50 MHz **Note 2, 3**	94	dBμ
1 % Cross-modulation Distortion 3	CM3	f_{RF} = 440 MHz, f_{IF} = 50 MHz **Note 2, 3**	94	dBμ

Notes 1. By test circuit 2

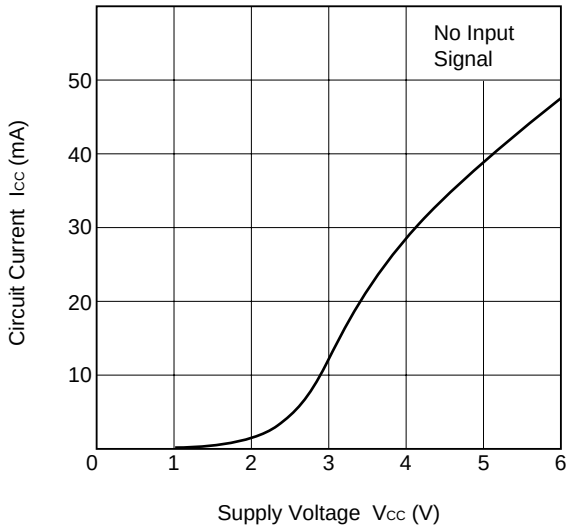
2. By test circuit 1

3. f_{undes} = f_{RF} ±12 MHz, P_{RF} = –31 dBm, P_{OSC} = –5 dBm

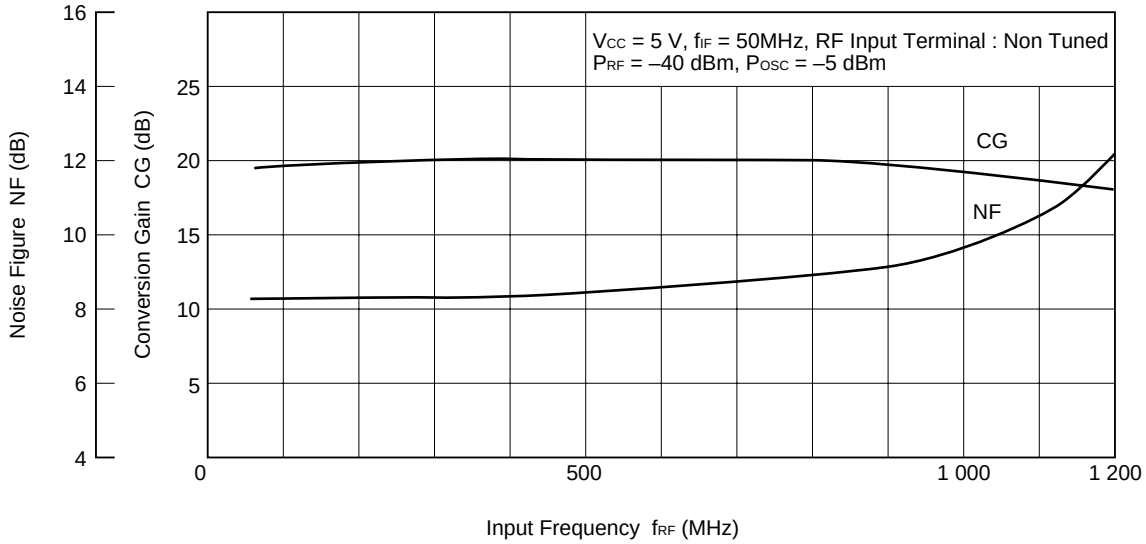
AM: 100 kHz, 30 % Mod., S/I Ratio = 46 dBc, output 75 Ω open

TYPICAL CHARACTERISTICS (T_A = +25 °C)

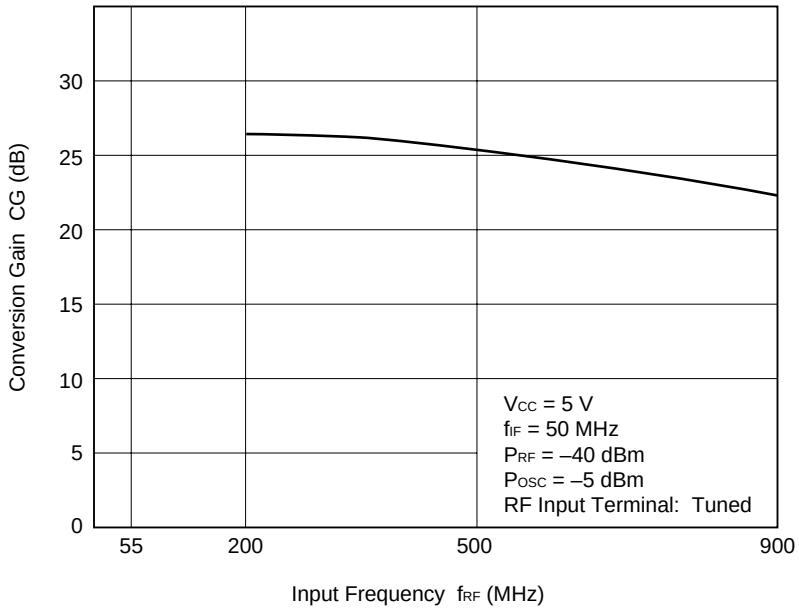
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



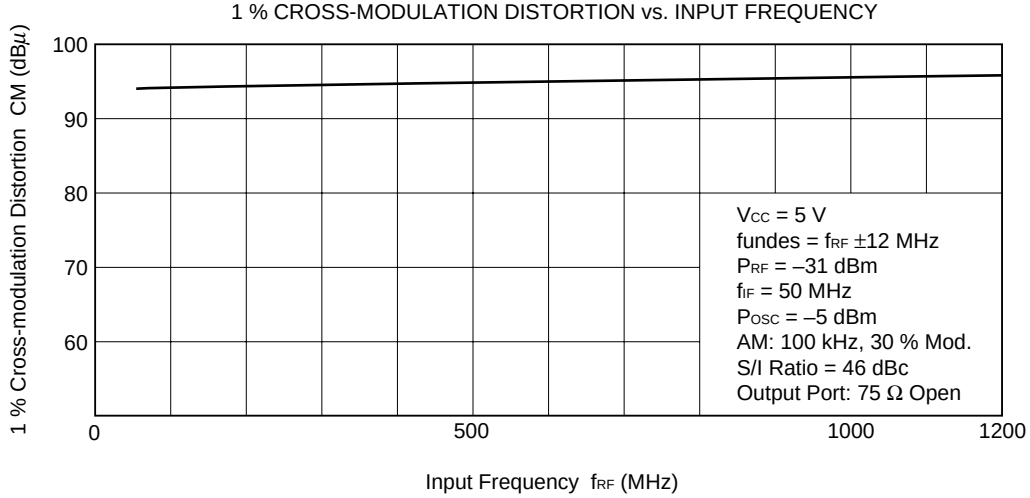
NOISE FIGURE AND CONVERSION GAIN vs. INPUT FREQUENCY



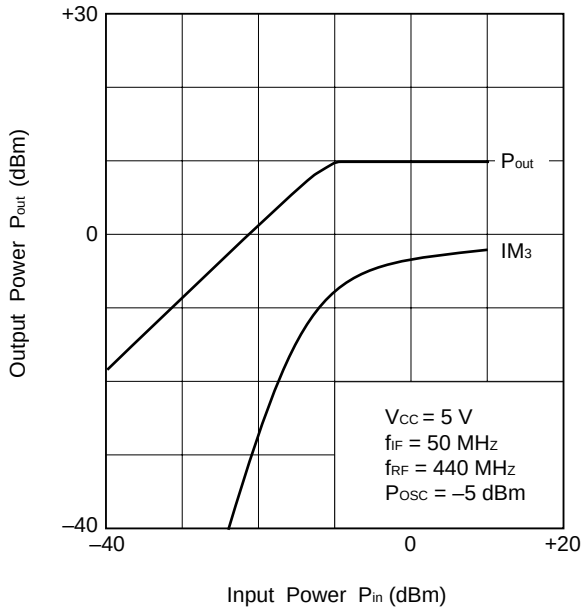
CONVERSION GAIN vs. INPUT FREQUENCY



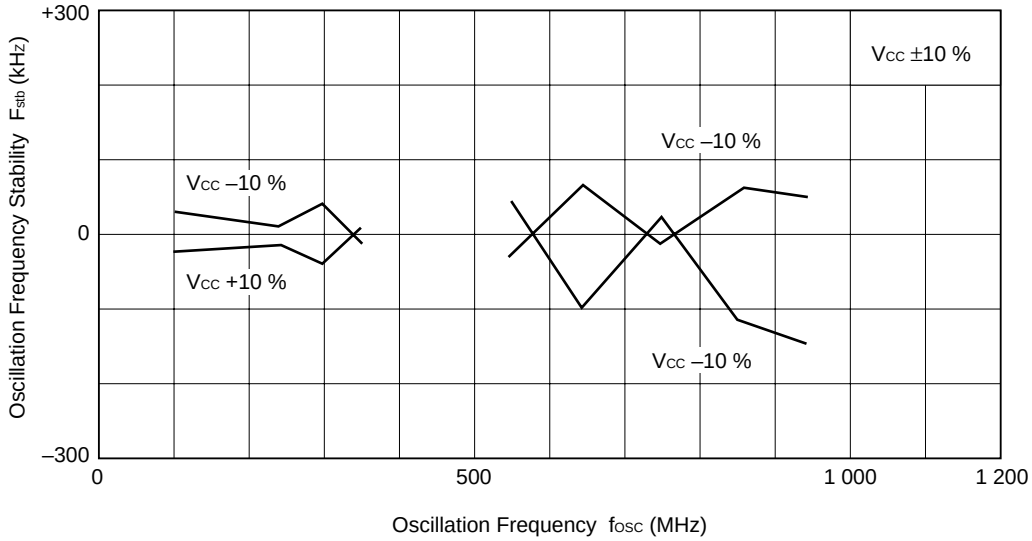
1 % CROSS-MODULATION DISTORTION vs. INPUT FREQUENCY



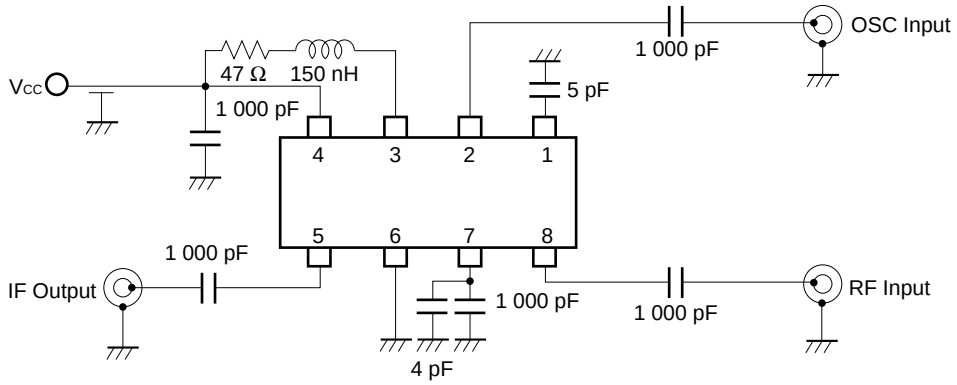
OUTPUT POWER vs. INPUT POWER



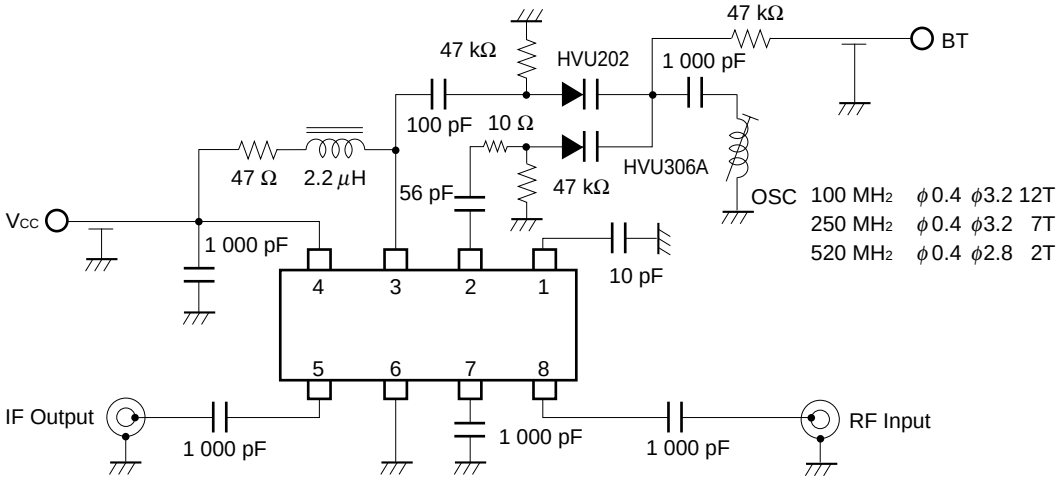
OSC-FREQUENCY STABILITY vs. OSC-FREQUENCY



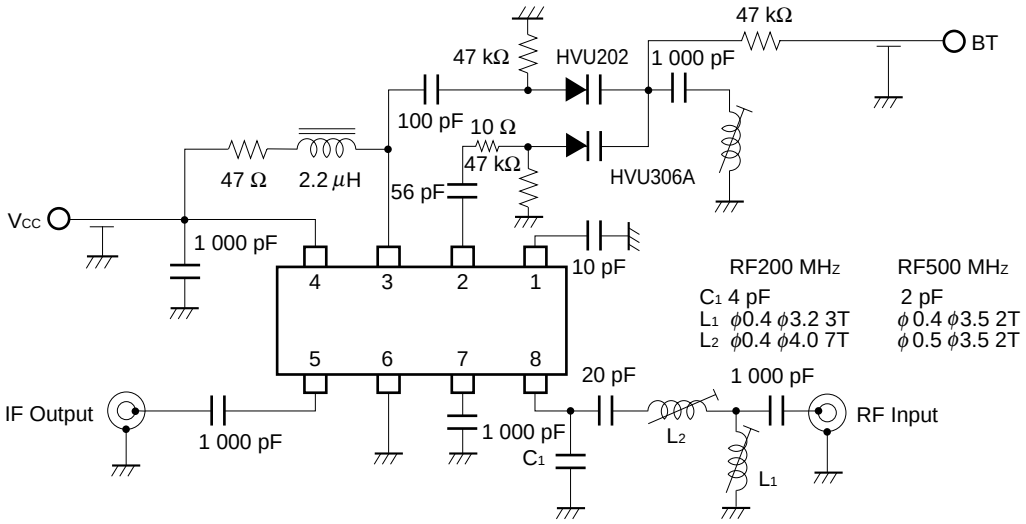
TEST CIRCUIT 1



TEST CIRCUIT 2

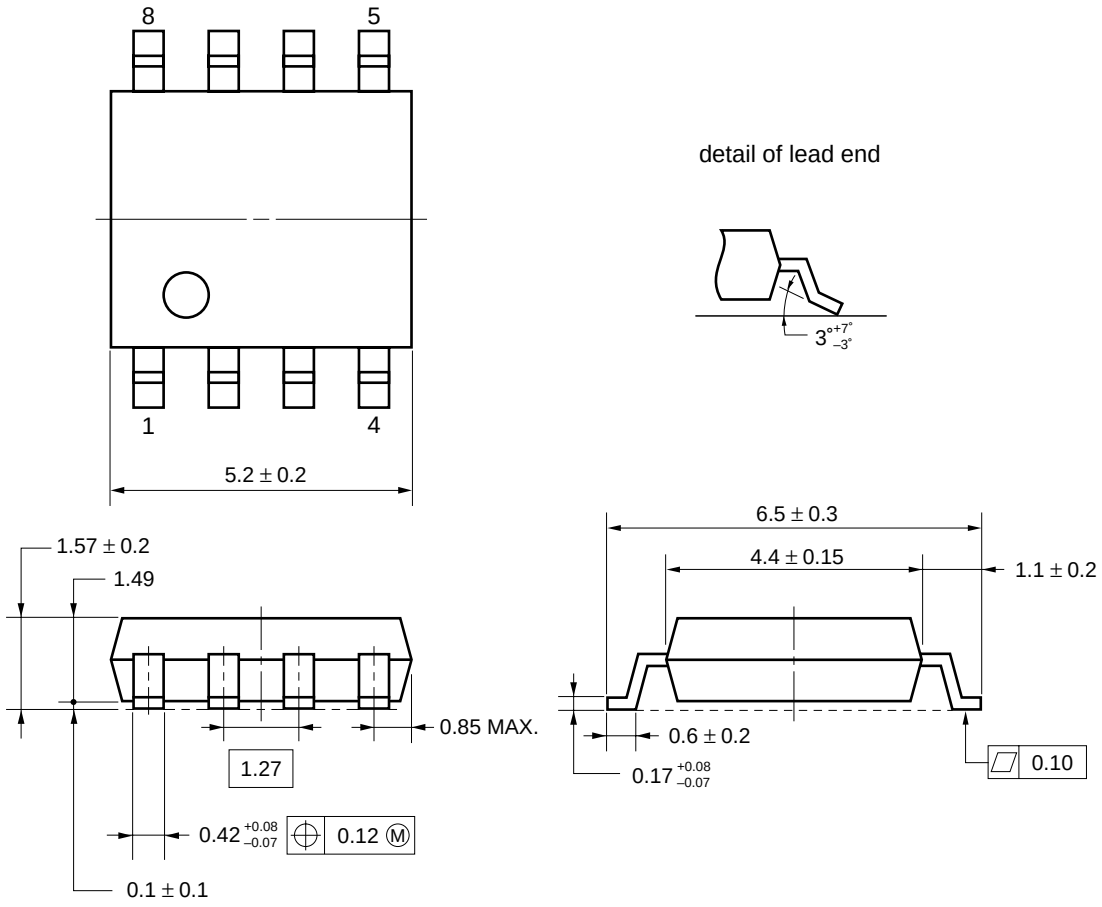


APPLICATION CIRCUIT EXAMPLE



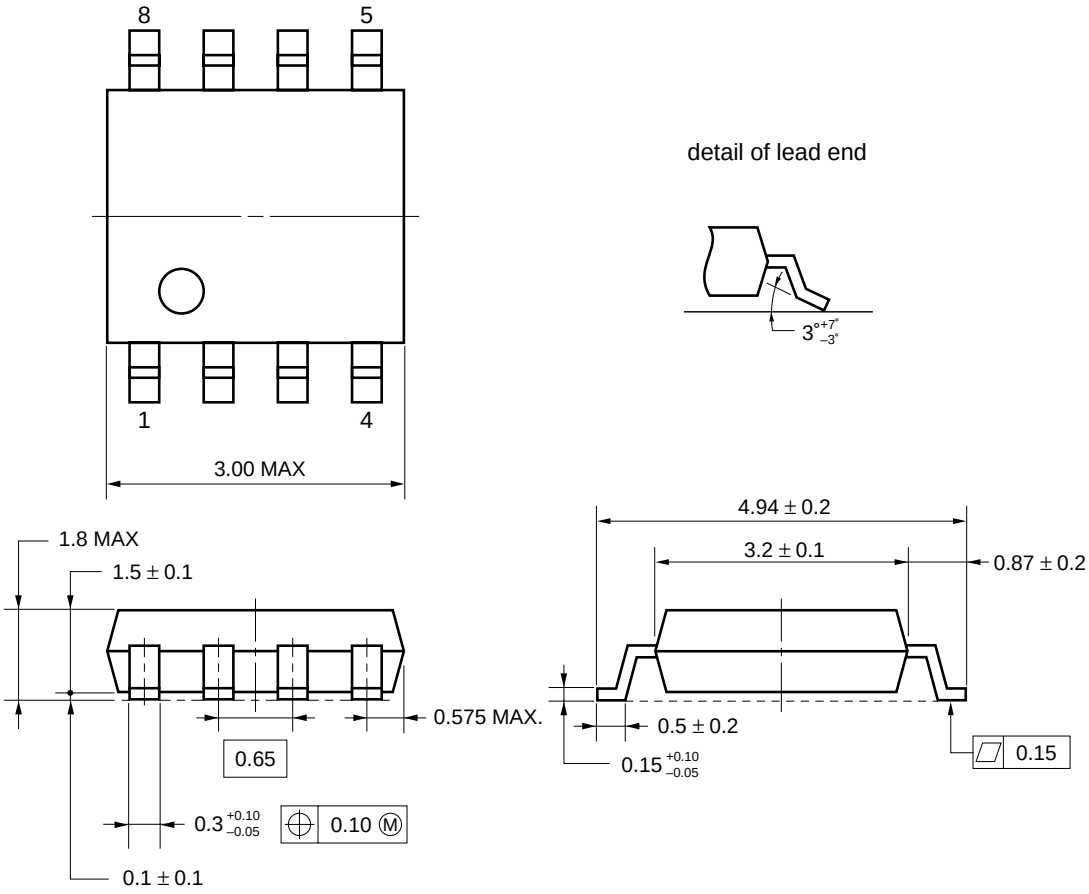
PACKAGE DIMENSIONS

★ **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.

8 PIN PLASTIC SSOP (175 mil) (UNIT: mm)



NOTE Each lead centerline is located within 0.10 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 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]

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