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
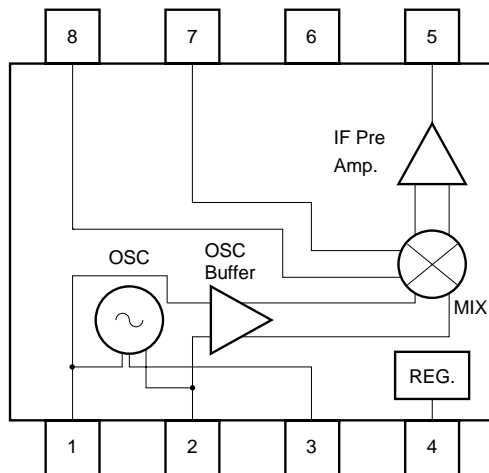- Receivers for UHF band

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)
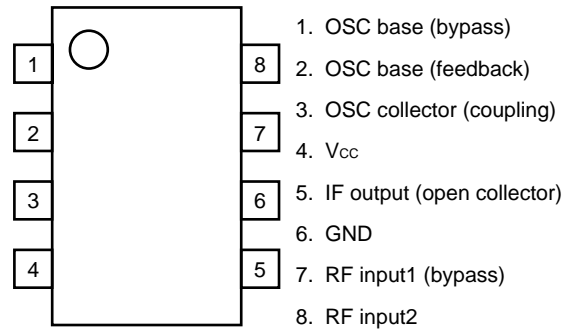
Caution Electro-static sensitive devices

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. Vcc
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 $50 \times 50 \times 1.6$-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)

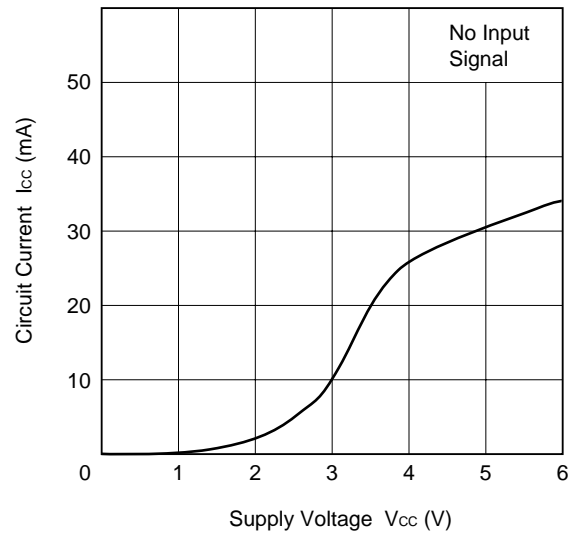| Parameter	Symbol	Test Conditions		MIN.	TYP.	MAX.	Unit
Circuit Current 1	$I_{CC}1$	No input signal	**Note**	21	31.5	40	mA
Conversion Gain 1	CG1	f_{RF} = 500 MHz, f_{IF} = 50 MHz, P_{RF} = −40 dBm, P_{OSC} = −5 dBm	**Note**	9.5	13.5	15.5	dB
Conversion Gain 2	CG2	f_{RF} = 900 MHz, f_{IF} = 50 MHz, P_{RF} = −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

Circuit Current I$_{CC}$ (mA)

No Input Signal

Supply Voltage V$_{CC}$ (V)

NOISE FIGURE AND CONVERSION GAIN vs. INPUT FREQUENCY

Noise Figure NF (dB)

Conversion Gain CG (dB)

V$_{CC}$ = 5 V
f$_{IF}$ = 50 MHz
RF Input Terminal: No Tuned
Test Circuit 1
P$_{RF}$ = −40 dBm
P$_{OSC}$ = −5 dBm

NF

CG

Input Frequency f$_{RF}$ (MHz)
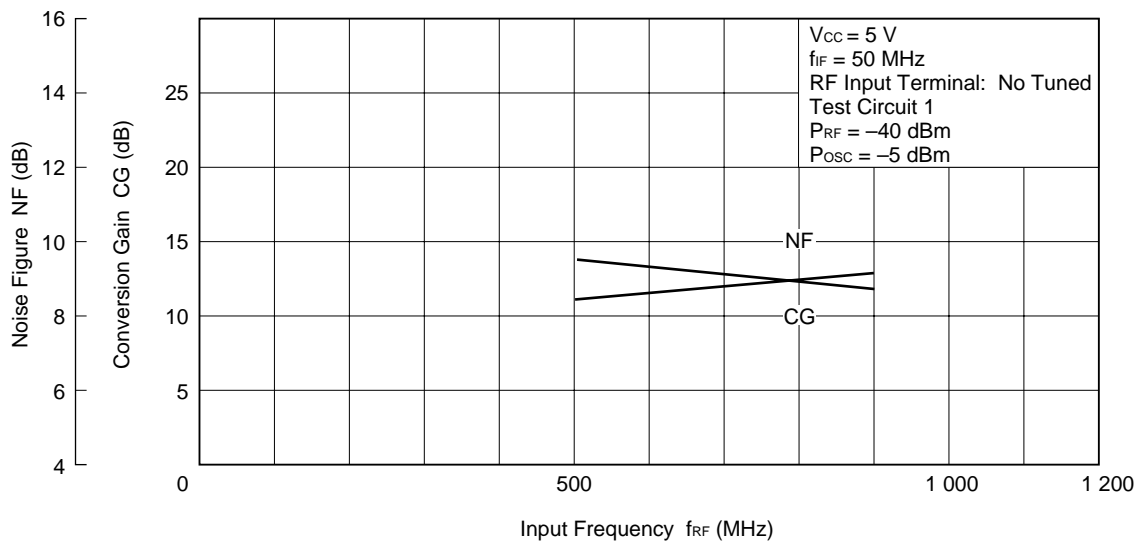
CONVERSION GAIN vs. INPUT FREQUENCY
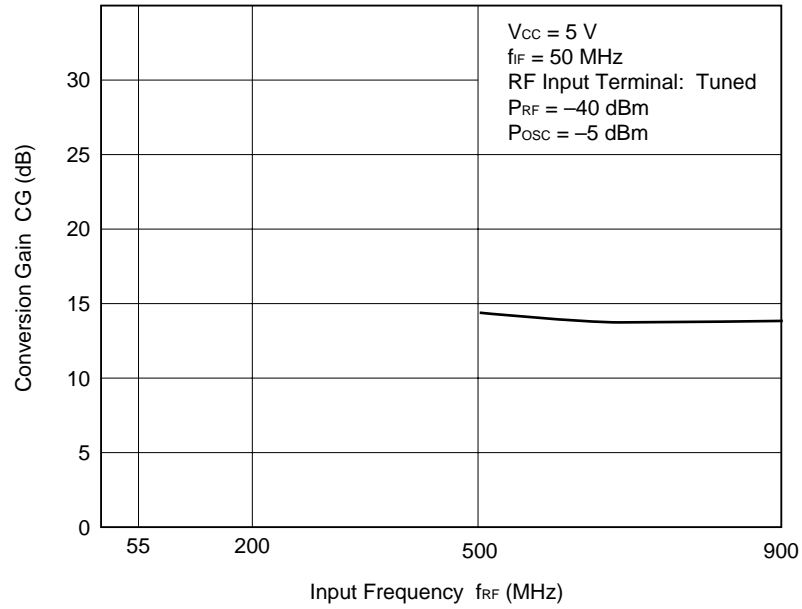
1 % CROSS-MODULATION DISTORTION vs. INPUT FREQUENCY
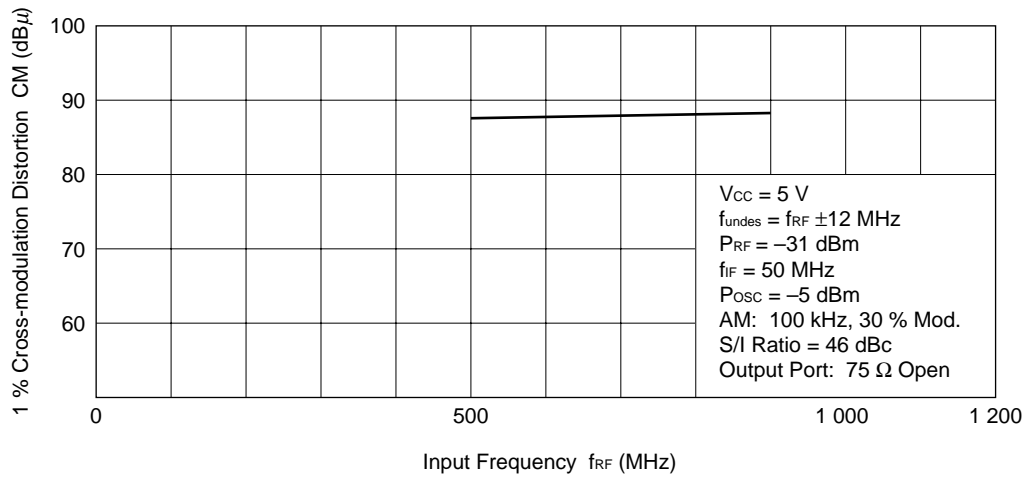
OUTPUT POWER vs. INPUT POWER

Output Power P_out (dBm)

+30

0

−40   −20   0   +40

Input Power P_in (dBm)

V_{CC} = 5 V
f_{RF} = 900 MHz
f_{IF} = 50 MHz
P_{OSC} = −5 dBm

P_out
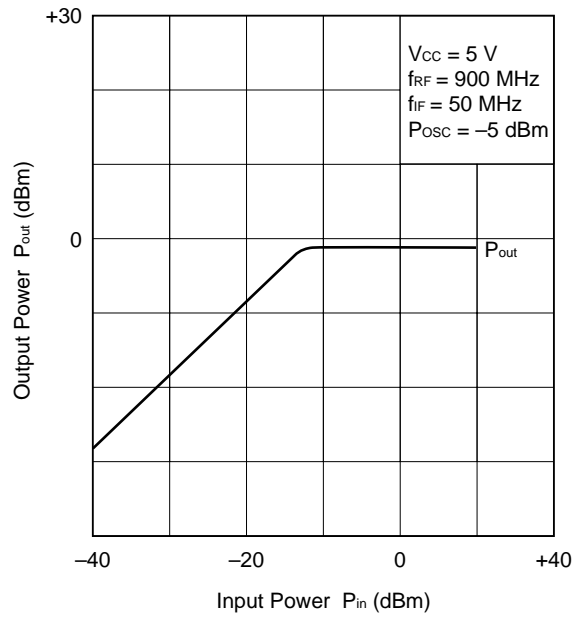
OSC-FREQUENCY STABILITY vs. OSC-FREQUENCY

Oscillation Frequency Stability F_stb (kHz)

+300

0

−300

0   500   1 000   1 200

Oscillation Frequency f_osc (MHz)

V_{CC} ±10 %

V_{CC} −10 %

V_{CC} +10 %
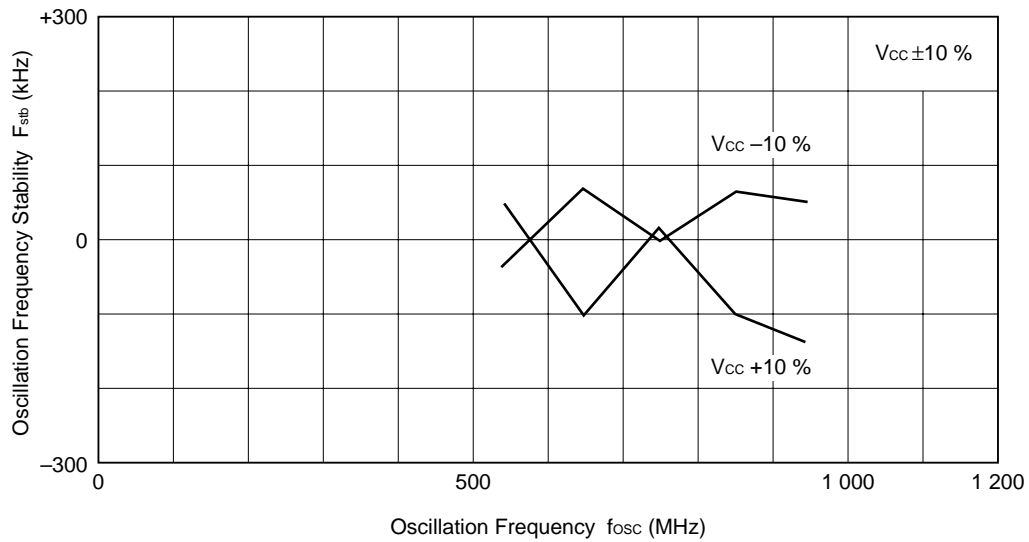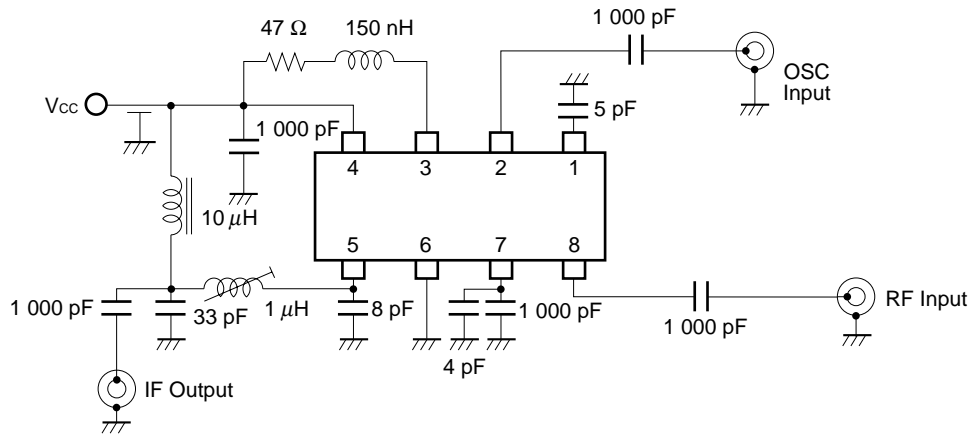
TEST CIRCUIT 1

TEST CIRCUIT 2
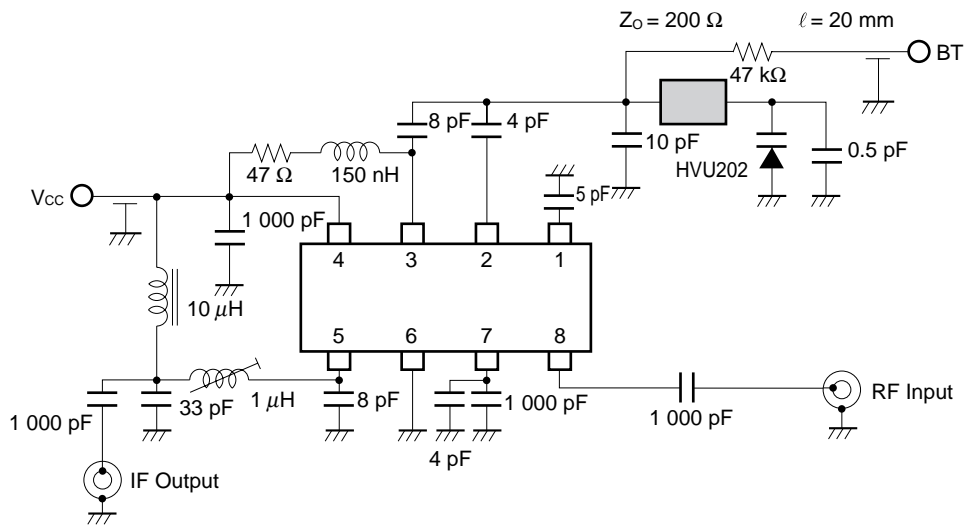
APPLICATION CIRCUIT EXAMPLE
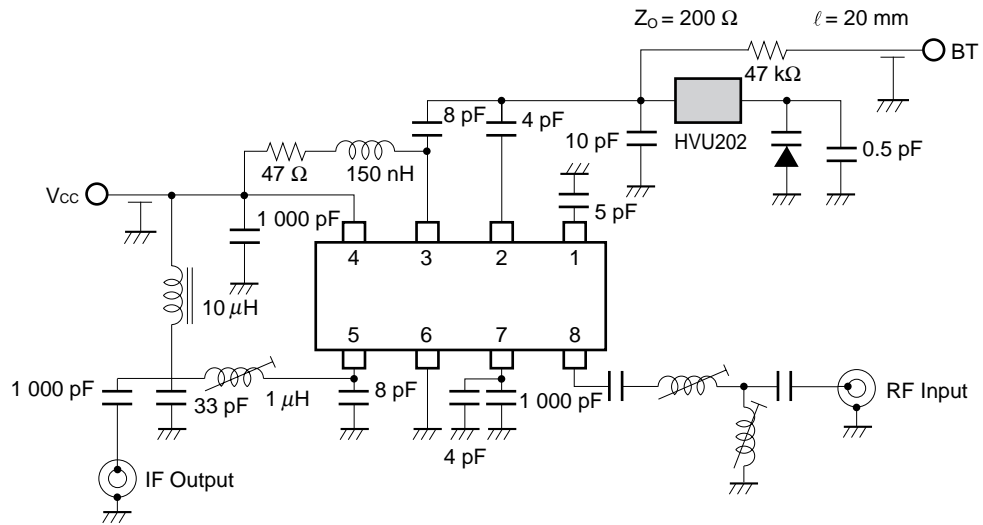
★ **PACKAGE DIMENSIONS**

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

detail of lead end

$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$

5.2 ± 0.2

1.57 ± 0.2

1.49

0.85 MAX.

1.27

0.42 $^{+0.08}_{-0.07}$ ⊕ 0.12 Ⓜ

0.1 ± 0.1

6.5 ± 0.3

4.4 ± 0.15

1.1 ± 0.2

0.6 ± 0.2

0.17 $^{+0.08}_{-0.07}$

� 0.10
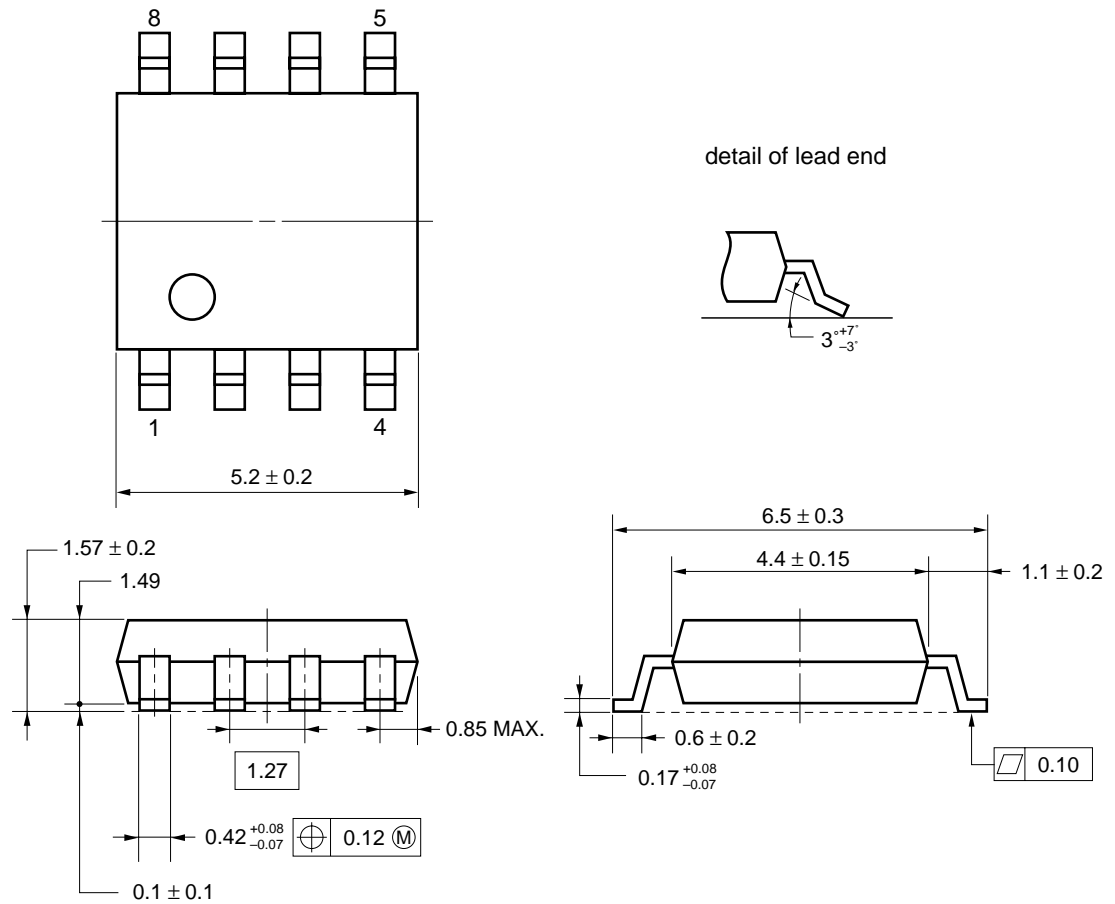
NOTE Each lead centerline is located within 0.12 mm of its true position (T.P.) at maximum material condition.

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[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).

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