

# TB6078FUG

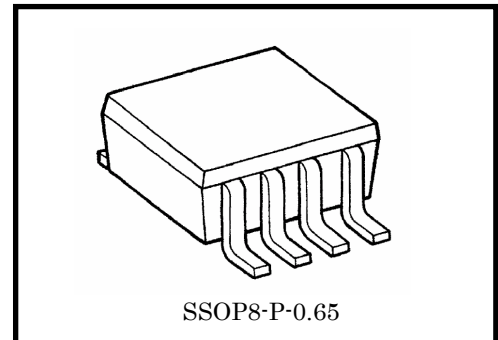
## Shock Sensor IC

TB6078FUG detects “shock” through the external shock sensor and output Low-level signal at 7 pin.

It has so excellent characteristic in low noise, and is suitable for application of mechanical control systems of HDD.

## Features

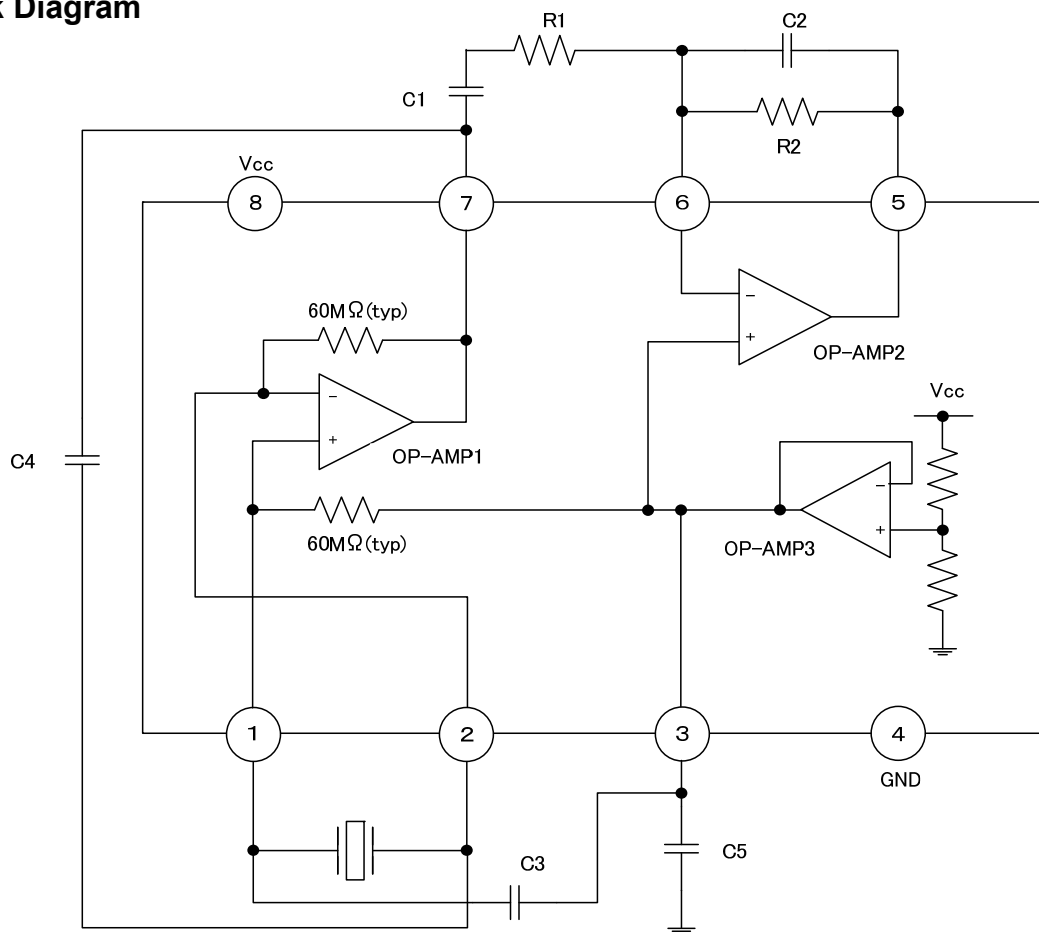
- Single power supply: 2.7 V to 5.5 V single power supply operation
- Two Operational-Amplifier is built in for design flexibility.  
It is possible to adjust frequency characteristic and gain by changing external devices
- Super small package: SSOP8-P-0.65 (0.65 mm pitch)



SSOP8-P-0.65

Weight: 0.02 g (typ.)

## Block Diagram

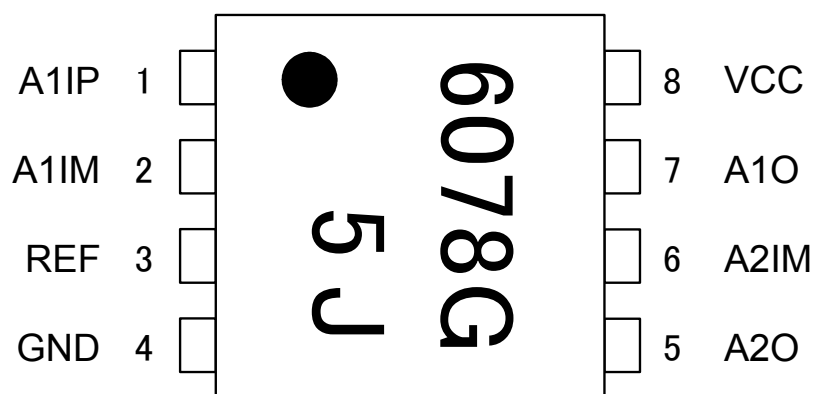


Note: Some of the functional blocks, circuits, or constants in the block diagram may be omitted or simplified for explanatory purpose.

## Pin Function

Pin No.	Pin Name	Function
1	A1IP	OP-AMP1 non-inverting input
2	A1IM	OP-AMP1 inverting input
3	REF	Reference voltage output
4	GND	Ground
5	A2O	OP-AMP2 output
6	A2IM	OP-AMP2 inverting input
7	A1O	OP-AMP1 output
8	VCC	Power supply voltage

## Pin Connection (top view)



(Marking example)

**Absolute Maximum Ratings (Ta = 25°C)**

Characteristics	Symbol	Rating	Unit
Power supply voltage	$V_{CC}$	6	V
Input voltage	$V_{IN}$	-0.3 to $V_{CC}+0.3$	V
Output voltage	$V_{OUT}$	-0.3 to $V_{CC}+0.3$	V
Power dissipation	$P_D$	250	mW
Storage temperature	$T_{stg}$	-55 to 125	°C

Note: The absolute maximum ratings of a semiconductor device are a set of ratings that must not be exceeded, even for a moment. Do not exceed any of these ratings.

Exceeding the rating(s) may cause device breakdown, damage or deterioration, and may result injury by explosion or combustion.

**Operating Condition**

Characteristics	Symbol	Rating	Unit
Power supply voltage	$V_{CC}$	2.7 to 5.5	V
Operating temperature	$T_{opr}$	-25 to 85	°C

Note: The IC may be destroyed due to short circuit between adjacent pins, incorrect orientation of device's mounting, connecting positive and negative power supply pins wrong way round, air contamination fault, or fault by improper grounding.

## Electrical Characteristics --- Guaranteed data (unless otherwise specified, $V_{CC} = 3.3\text{ V}$ , $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Supply current	$I_{CC}$	(1)	$V_{CC} = 3.3\text{ V}$	—	2.1	3.6	mA
			$V_{CC} = 5.0\text{ V}$	—	2.2	3.9	

## OP-AMP Characteristics

### (OP-AMP1)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output DC voltage	$V_{dc1}$	(2)	No input signal	1.50	1.60	1.70	V
Output load change (source)	$V_{source1}$	(3)	$\Delta V$ when the source current is changed from 0 to 0.5 mA	-100	—	—	mV
Output load change (sink)	$V_{sink1}$	(4)	$\Delta V$ when the sink current is changed from 0 to 80 $\mu\text{A}$	—	—	100	mV

### (OP-AMP2)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input current	$I_{in}$	(5)	—	-50	—	50	nA
Output DC voltage	$V_{dc2}$	(6)	—	1.57	1.65	1.73	V
Output voltage range (Low side)	$V_{ol2}$	(7)	—	—	—	0.3	V
Output voltage range (High side)	$V_{oh2}$	(8)	—	$V_{CC}-0.3$	—	—	V
Output source current	$I_{As02}$	(9)	$V_{oh} = V_{CC} - 0.3\text{ V}$	80	180	—	$\mu\text{A}$
Output sink current	$I_{Asi2}$	(10)	$V_{ol} = 0.3\text{ V}$	0.5	1.8	—	mA

### (OP-AMP3)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Reference Voltage	$V_{ref}$	(11)	—	1.60	1.65	1.70	V
Output load change (source)	$V_{source3}$	(12)	$\Delta V_{ref}$ when the source current is changed from 0 to 100 $\mu\text{A}$	-100	—	—	mV
Output load change (sink)	$V_{sink3}$	(13)	$\Delta V_{ref}$ when the sink current is changed from 0 to 70 $\mu\text{A}$	—	—	100	mV

## Electrical Characteristics--- Reference data for application (Note)

## (OP-AMP1)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input bias voltage	$V_{in}$	(14)	No input signal	1.32	1.46	1.64	V
Input impedance	$Z_{in}$	(15)	—	—	60	—	M $\Omega$
Offset voltage	$V_{off1}$	(16)	No input signal	-200	—	200	mV
GBW (Cut-off frequency)	$f_{T1}$	(17)	—	—	5.5	—	MHz

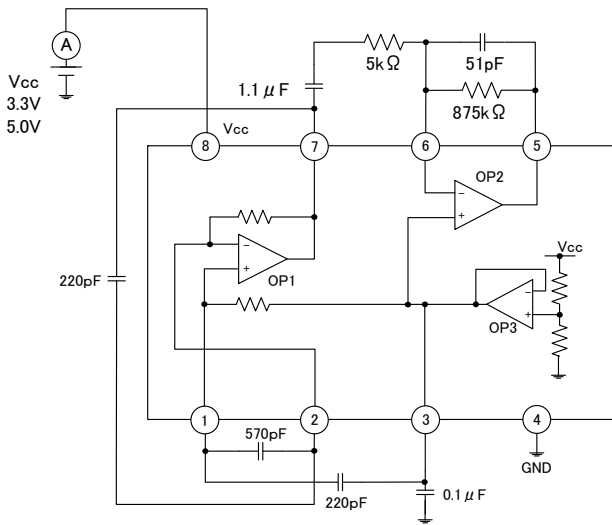
## (OP-AMP2)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
GBW (Cut-off frequency)	$f_{T2}$	(18)	—	—	2.3	—	MHz
Offset voltage	$V_{off2}$	(19)	—	-20	—	20	mV

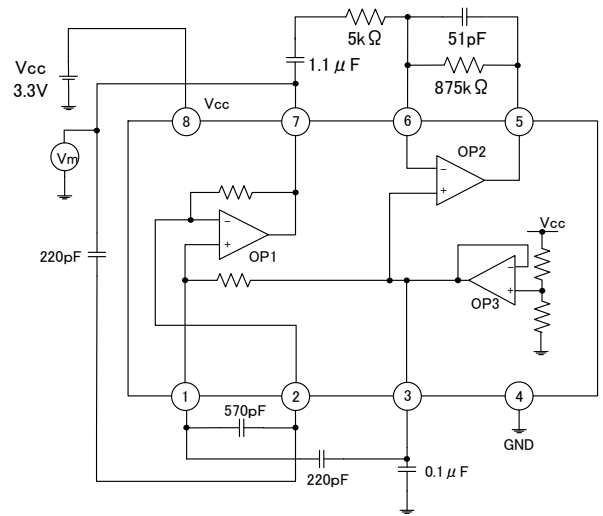
Note: The "reference data for application" shown in this document are provided for reference purposes only. Especially, thorough evaluation is required on the phase of mass production design.

**Test Circuit**

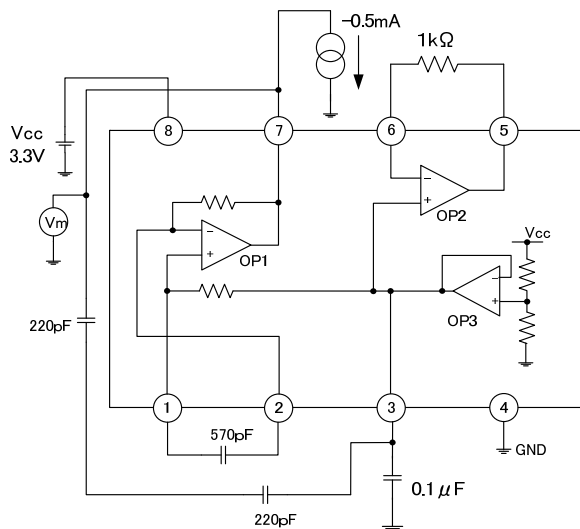
(1) Supply current:  $I_{CC}$



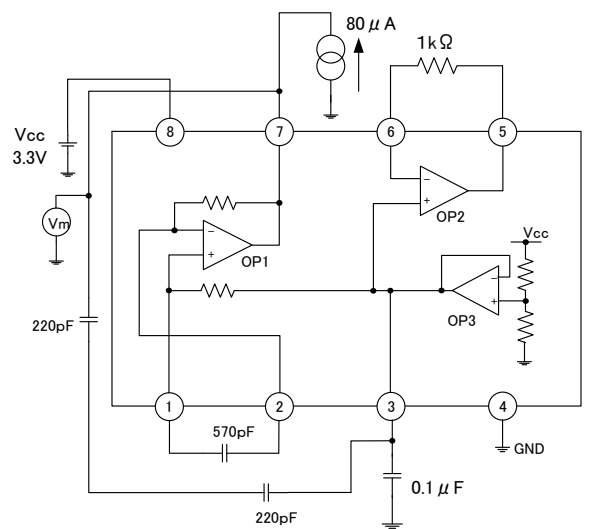
(2) OP-AMP1 Output DC voltage



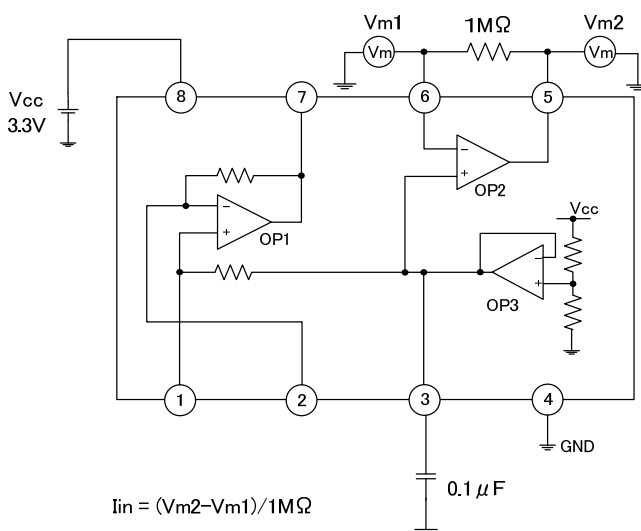
(3) OP-AMP1 Output load change (source)



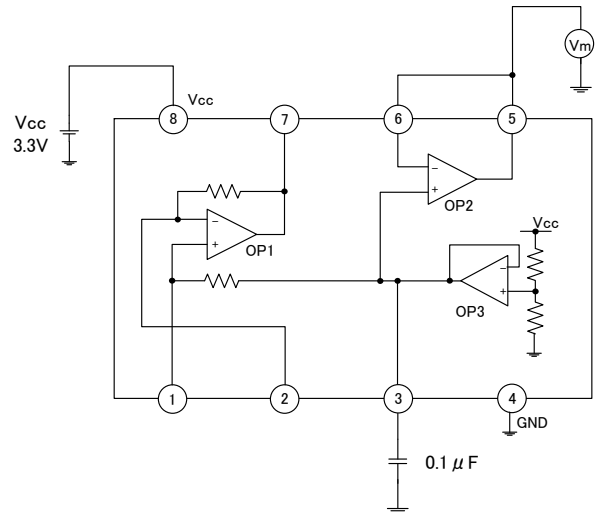
(4) OP-AMP1 Output load change (sink)



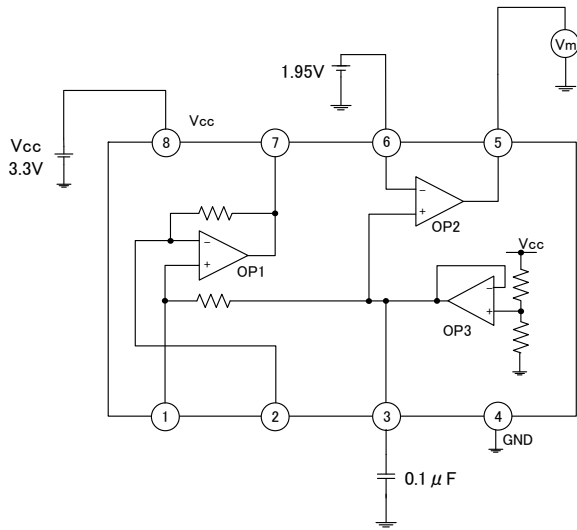
(5) OP-AMP2 Input current



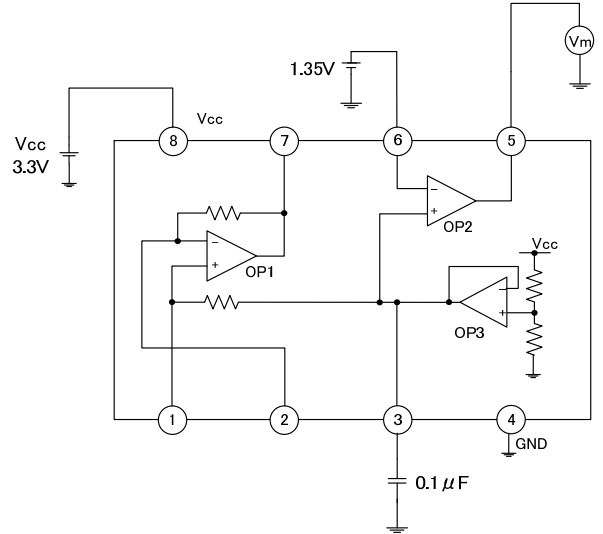
(6) OP-AMP2 Output DC voltage



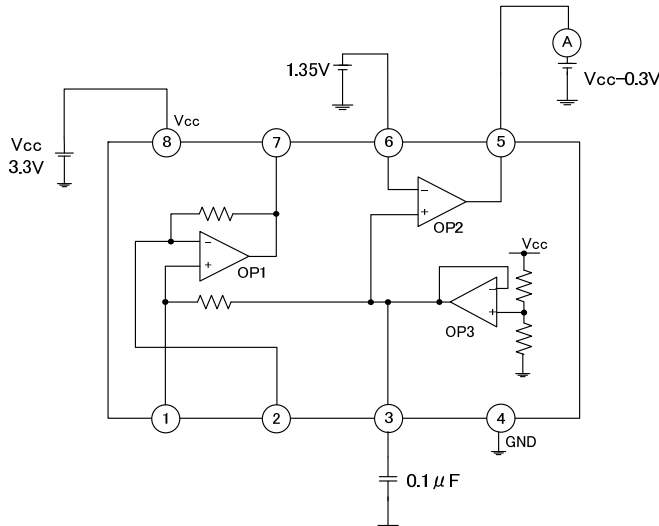
(7) OP-AMP2 Output voltage range (L side)



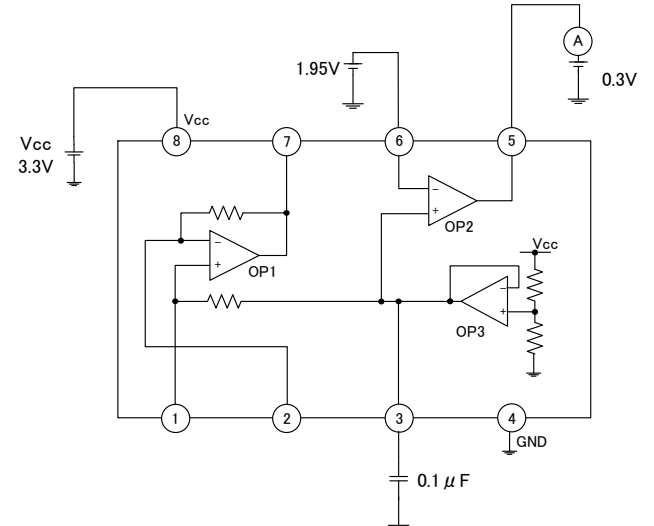
(8) OP-AMP2 Output voltage range (H side)



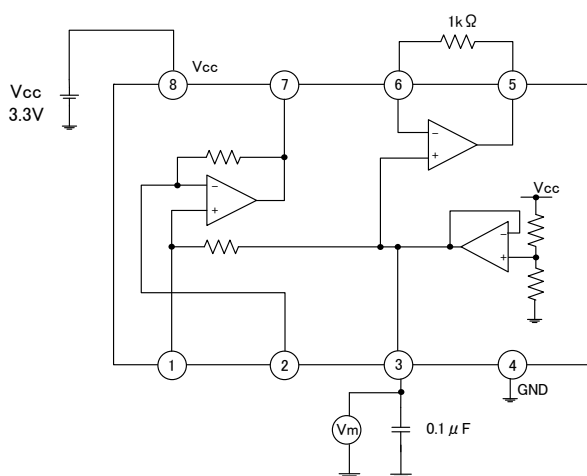
(9) OP-AMP2 Output source current



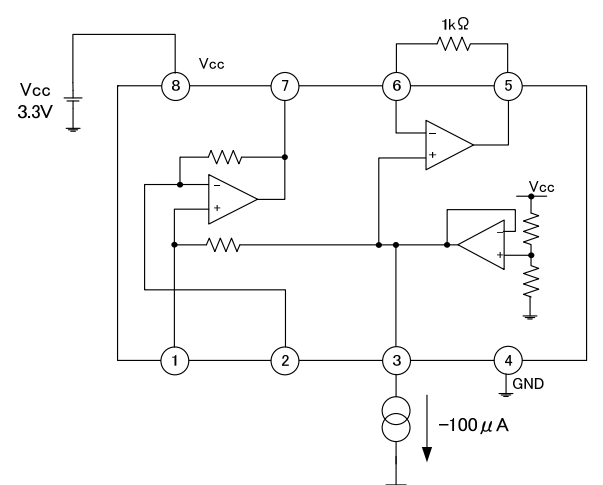
(10) OP-AMP2 Output sink current



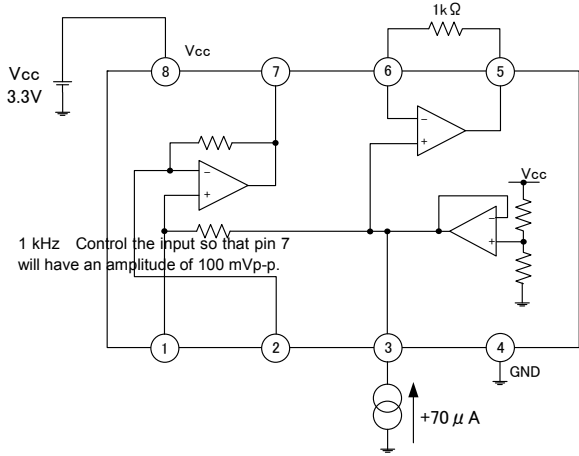
(11) OP-AMP3 Reference voltage (1/2Vcc)



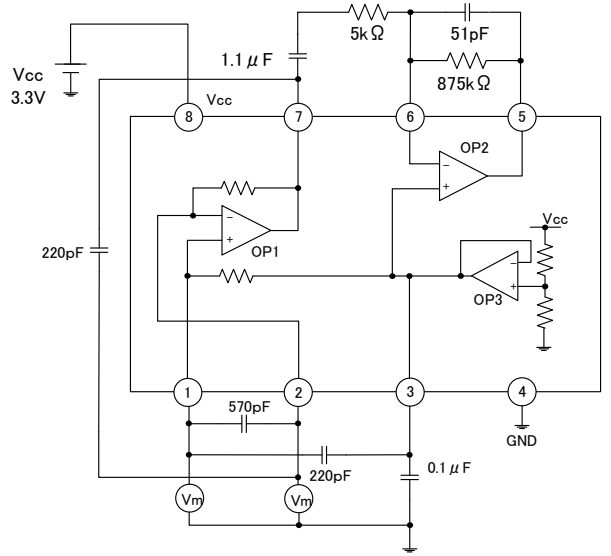
(12) OP-AMP3 Output load change (source)



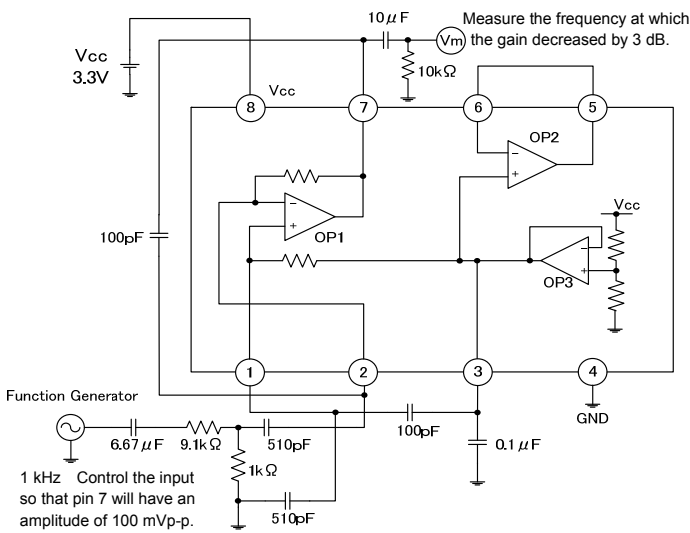
(13) OP-AMP3 Output load change (sink)



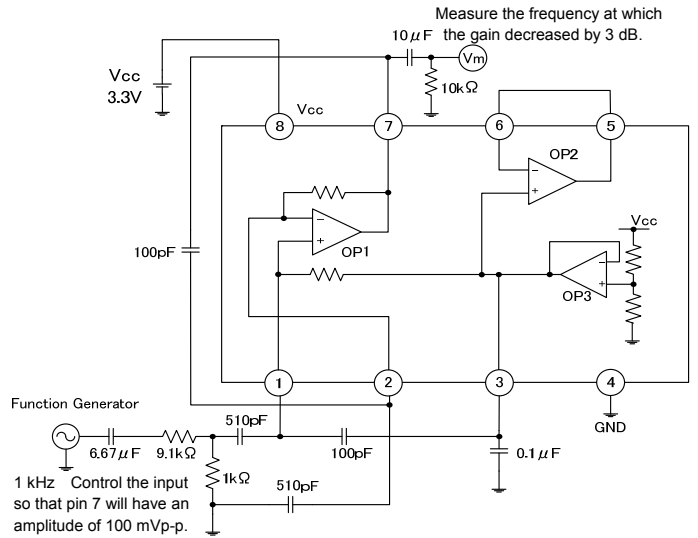
(14) OP-AMP1 Input bias voltage



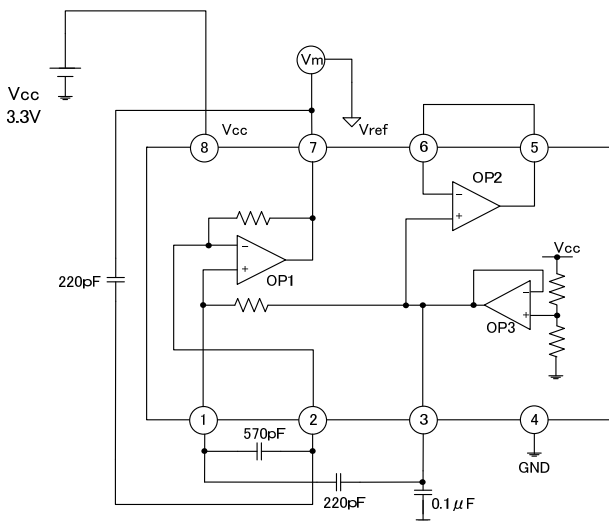
(15) OP-AMP1 Input impedance



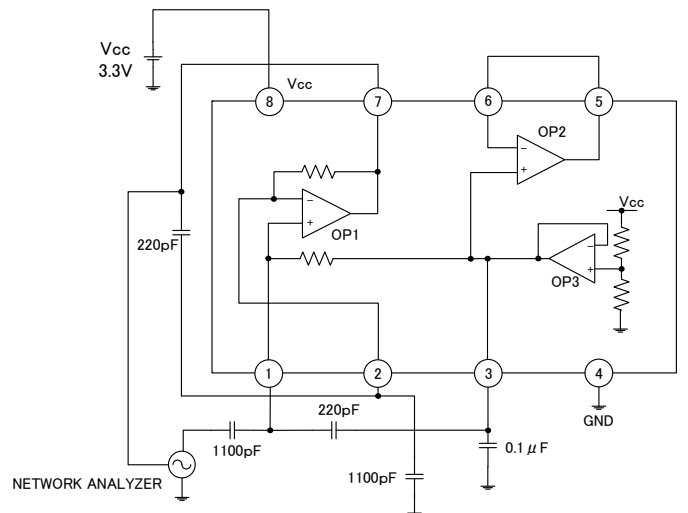
(15) OP-AMP1 Input impedance



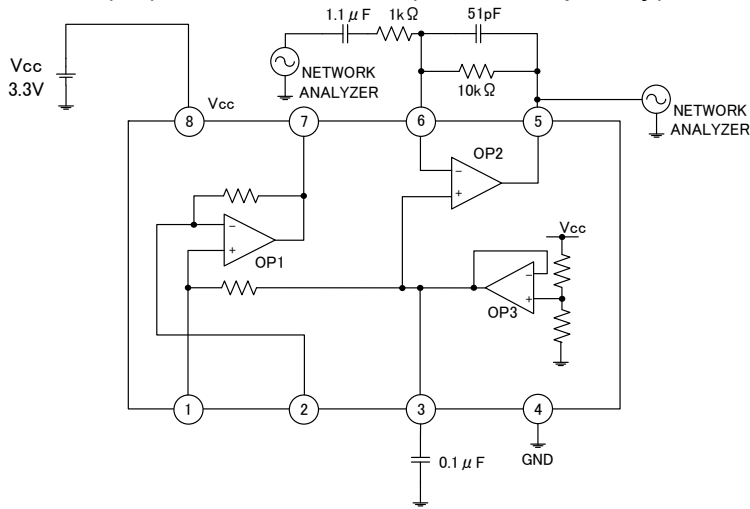
(16) OP-AMP1 Output offset voltage



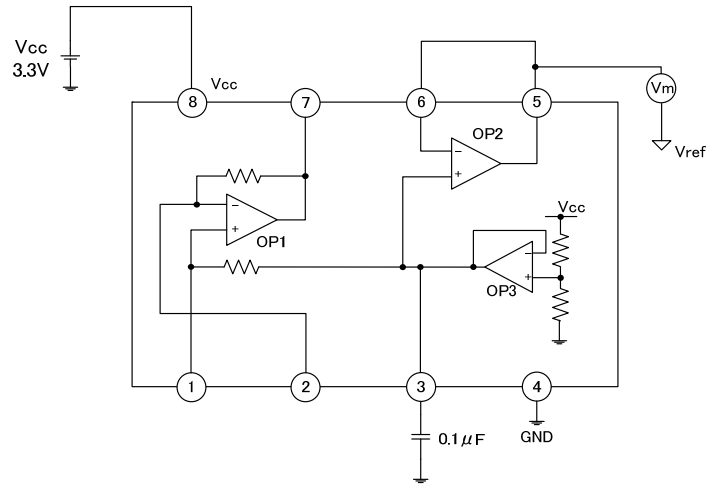
(17) OP-AMP1 GBW (cut-off frequency)



(18) OP-AMP2 GBW (cut-off frequency)



(19) OP-AMP2 Output offset voltage

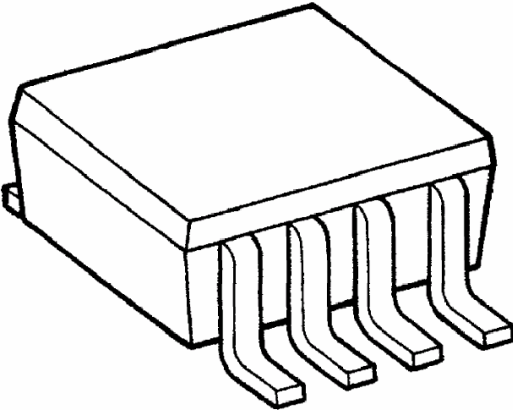
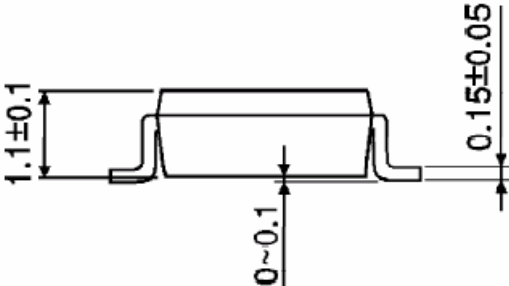
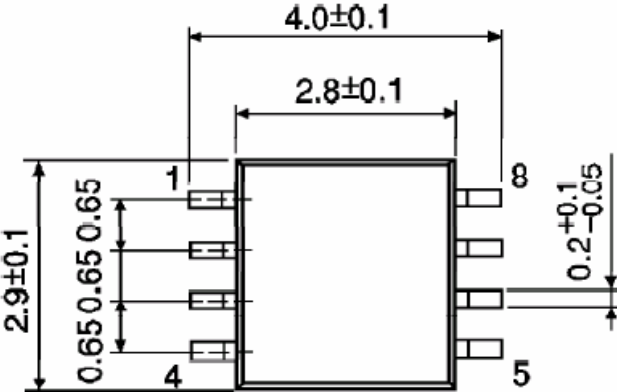


Note: Components in the test circuits are only used to obtain and confirm the device characteristics. These components and circuits do not warrant to prevent the application from malfunction from malfunction or failure.

Package Dimensions

SSOP8-P-0.65

Unit: mm



About solderability, following conditions were confirmed

\*Solderability

(1)Use of Sn-37Pb solder Bath

\*solder bath temperature = 230°C

\*dipping time = 5 seconds

\*the number of times = once

\*use of R-type flux

(2)Use of Sn-3.0Ag-0.5Cu solder Bath

\*solder bath temperature = 245°C

\*dipping time = 5 seconds

\*the number of times = once

\*use of R-type flux

## RESTRICTIONS ON PRODUCT USE

20070701-EN GENERAL

- The information contained herein is subject to change without notice.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.  
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc.
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patents or other rights of TOSHIBA or the third parties.
- Please contact your sales representative for product-by-product details in this document regarding RoHS compatibility. Please use these products in this document in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances. Toshiba assumes no liability for damage or losses occurring as a result of noncompliance with applicable laws and regulations.