Gyro sensor MEV series

Sensor Products Eng. Sec. I
Sensor Products Dept.
Murata MFG., Co. LTD.
Mar 2008

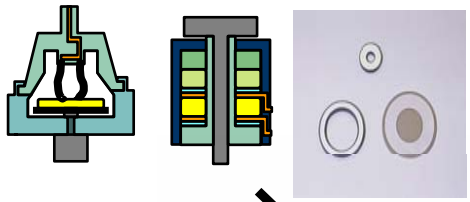
muRata
Innovator in Electronics

Applications for car electronics

Acceleration

Engine control

Ceramic element for Knocking sensors



Airbag

Shock sensors

TPMS-Tx

Shock sensors

Angular velocity

Car-navigation

Gyro sensors

Car security

Ultrasonic sensors

(Open type)

Parking assist/aid

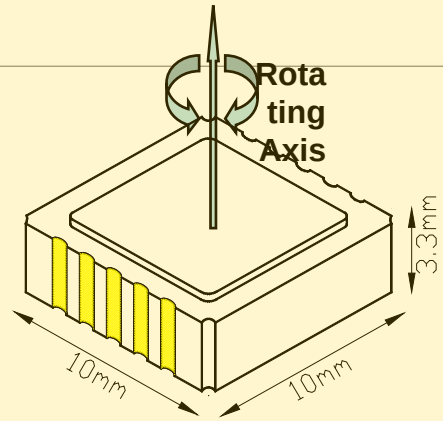
Ultrasonic sensors

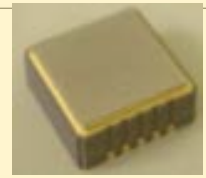
(Water proof type)

Ultrasound

Feature of MEV-50A

Display





Gyro sensor

SPEED

GPS

CPU

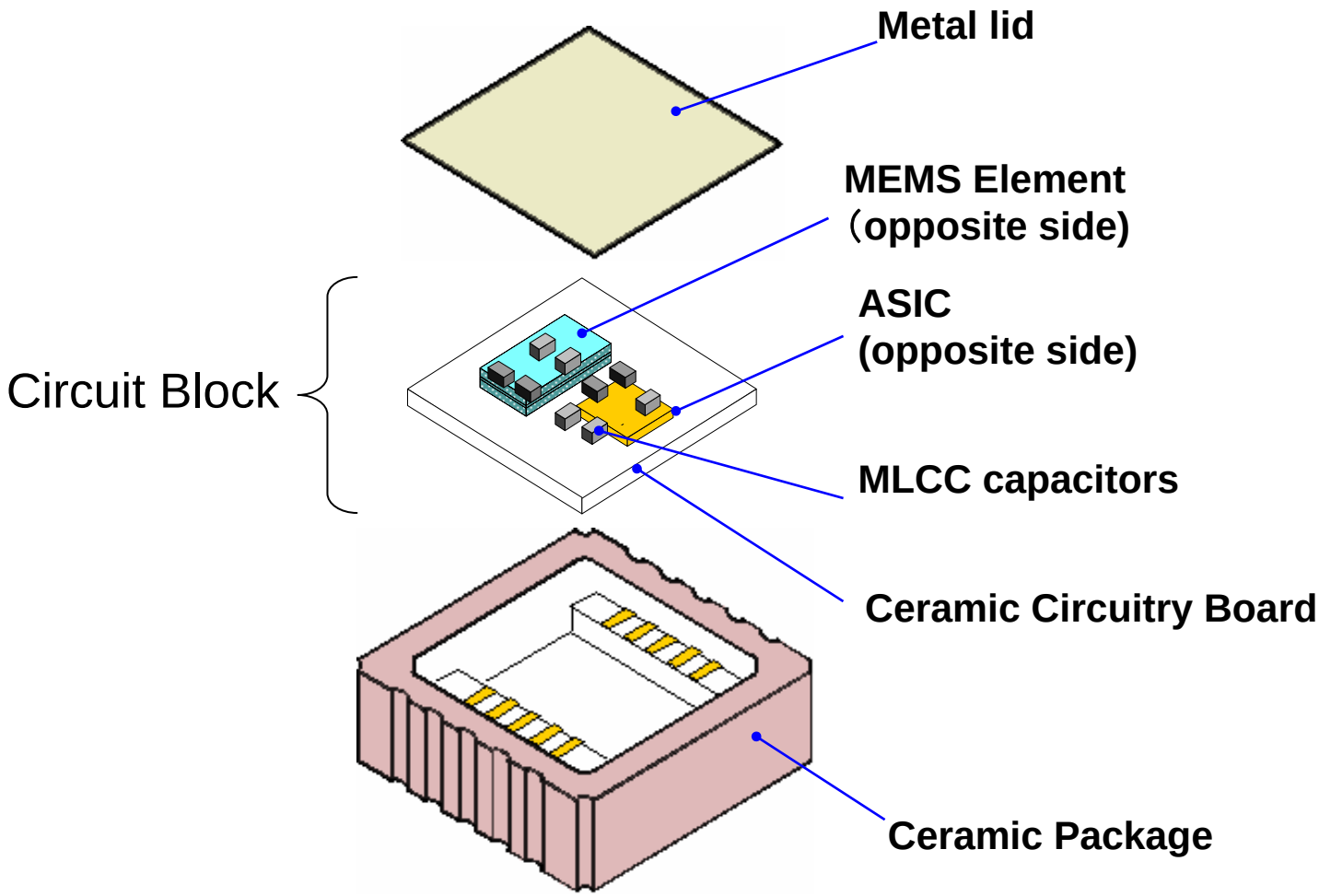
VICS

Storage media for map information

HDD
DVD
CD-ROM
IC card
etc.

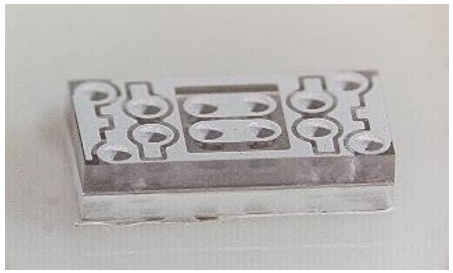
- **Excellent stability vs. temp.**
  - Constructed with single material
  - Digitally compensated output signal
  - Ceramic hermetic sealed package
- **Excellent isolation from linear acceleration**

Structure of MEV-50A

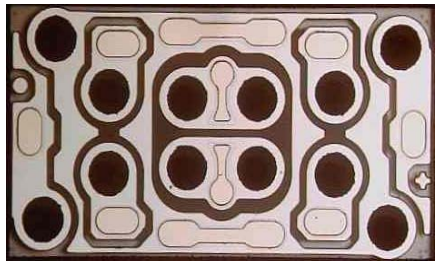


Schematic Structure of MEMS Element

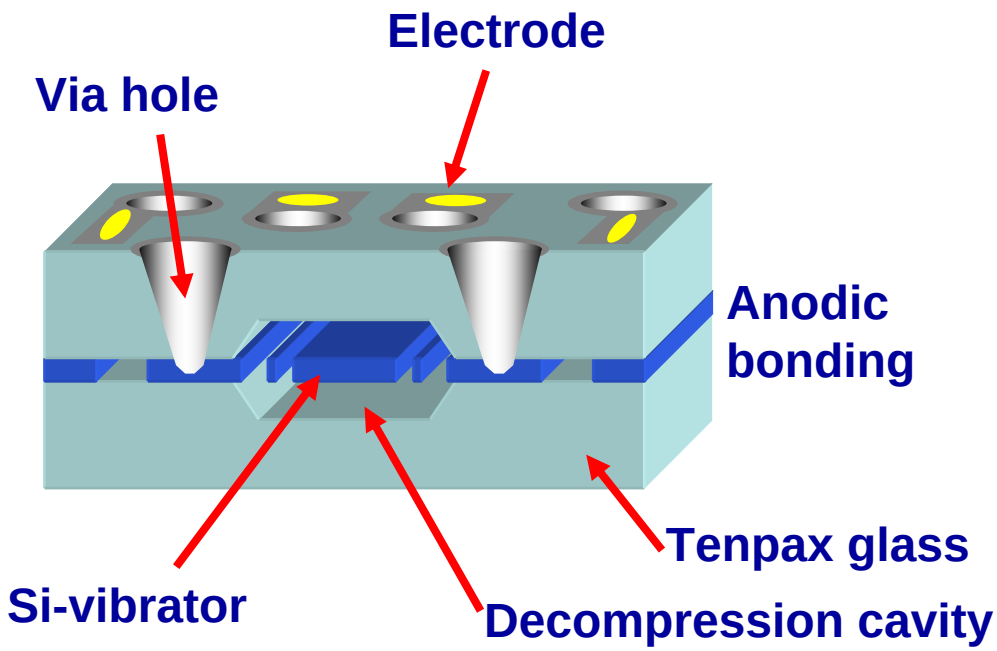
External structure



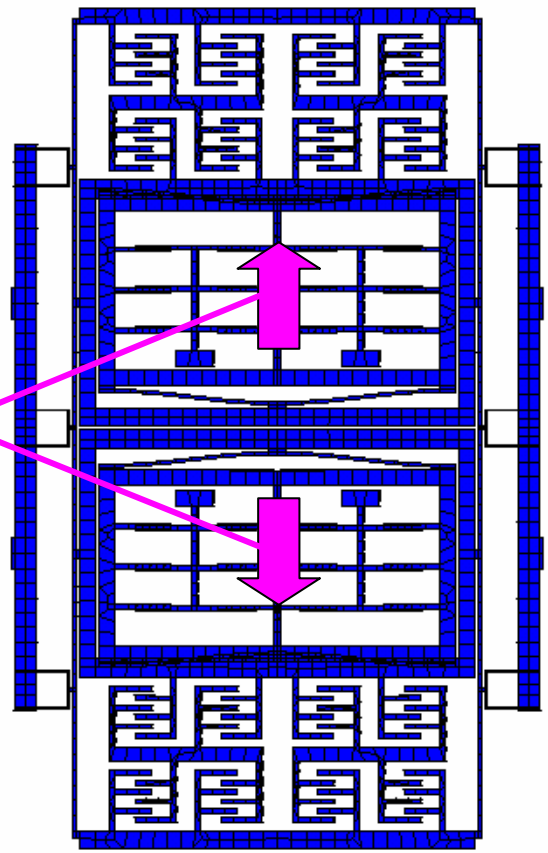
External electrodes

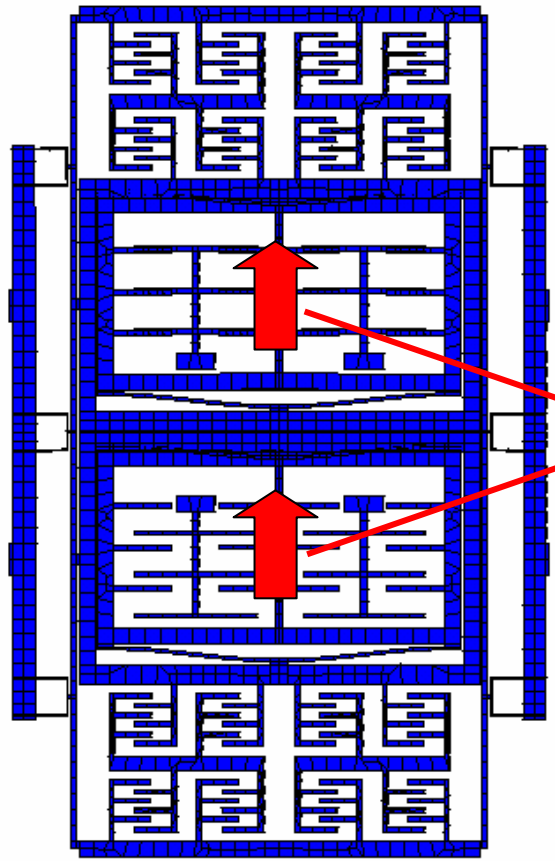


W3.9*D2.0*h0.9 (mm)



Isolation between angular velocity and acceleration





Capacitive variation

+ΔC

Coliolis Force

+ΔC

Capacitive variation

+ΔC

Acceleration

-ΔC

Y

X

Applying angular velocity **Applying acceleration**

Because of the unique construction, the MEMS element maximizes angular velocity and eliminates linear acceleration.

Electrical characteristics

Unless otherwise specified, ambient temperature Ta = 25+/-5°C, Vcc = 5.0 VDC
Use the load resistor of 100k ohm or more, connecting to the sensor output terminal.

Item	Symbol	Condition	MIN.	STD.	MAX.	Unit
Zero point output	Vo	at -40~85°C	2.20	2.50	2.80	V
Scale factor	Sv	at -40~85°C	23.25	25.0	26.75	mV/(deg/s)
Maximum output voltage			Vcc-0.3			V
Minimum output voltage					0.3	V
Linearity-error			-0.5		0.5	%FS
Output noise					10	mVp-p
Startup time		(see Note1)			1	s
Start up drift		1s ~ 5minutes	-0.4		0.4	deg/s
		1s ~ 15minutes	-0.8		0.8	deg/s
Temp. drift		at -40 ~ 85°C			6	deg/s
Temp. drift gradient		at -40 ~ 85°C	-0.5 -1.0		0.5 1.0	(deg/s)/2°C (deg/s)/8°C
Temp. coefficient Scale factor		reference : Ta at -40 ~ 85°C	-4		4	%
Frequency response (Frequency vs. Gain)		gain at 7Hz	-4.0		-1.0	dB
Cross axis sensitivity		on each X,Y axis	-5		5	%
Ratiometric for zero point output	Rvo	at 4.75~5.25V (Note2)	0.8		1.2	
Ratiometric for scale factor	Rsv	at 4.75~5.25V (Note3)	0.8		1.2	
Acceleration sensitivity under the vibrational condition (Note 4)		at 10~2,000Hz, 21.56m/s^2 (2.2G) X, Y, Z axis	-1		1	deg/s

(Note1) After the power on, monitor a time that zero point output has been within +/-12.5mV against zero point output value of being steady.

(Note2) Ratiometric of zero point output (Rvo) is prescribed as follow formula,

Rvo = Vo variation / Vcc variation
Vo variation = {Vo(5.25)-Vo(4.75)} / V0(5.0)
Vcc variation = (5.25-4.75) / 5.0 = 0.1

(Note3) Ratiometric of scale factor (Rsv) is prescribed as follow formula,

Rsv = Sv variation / Vcc variation
Sv variation = {Sv(5.25)-Sv(4.75)} / V0(5.0)
Vcc variation = (5.25-4.75) / 5.0 = 0.1

(Note 4) Measurement errors, such as output noise, angular velocity unexpectedly generated by vibration machine, should not be considered to be acceleration sensitivity. Only DC voltage level, which does not contain the measurement errors, should be measured in this specification.

Max. angular velocity

Item	MIN	TYP	MAX	Unit	Conditions
Operating range of angular velocity	-70		70	deg/s	
Supply voltage	4.75	5.00	5.25	V	
Current consumption			8	mA	see Note 2
Operating temp. range	-40		85	°C	

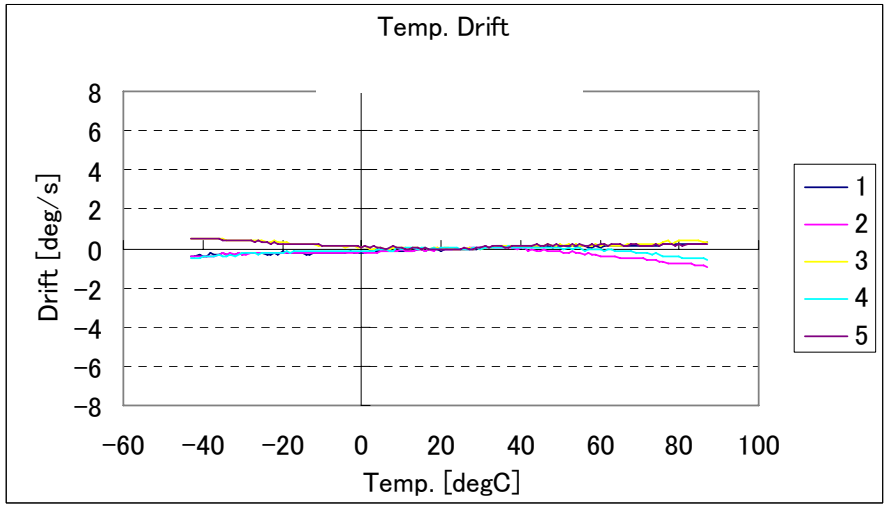
(Note 2) Non-load condition to the sensor output.

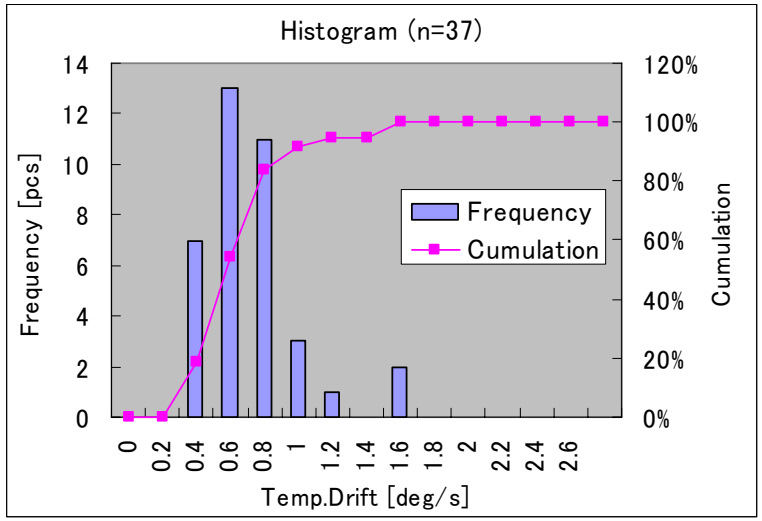
Operating range of angular velocity over temperature

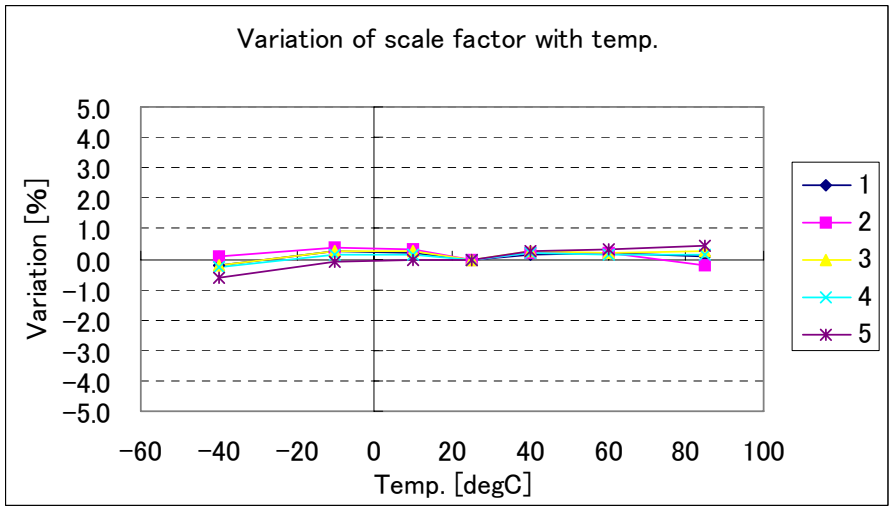
Vcc	Saturation of output		Zero point output		Scale factor	Max. angular velocity	
	LOW	HIGH	LOW	HIGH	MAX.	CCW	CW
5.250	0.300	4.950	2.310	2.940	28.088	-71.6	71.6
5.000	0.300	4.700	2.200	2.800	26.750	-71.0	71.0
4.750	0.300	4.450	2.090	2.660	25.413	-70.4	70.4
[V]	[V]	[V]	[V]	[V]	[mV/(deg/s)]	[deg/s]	[deg/s]

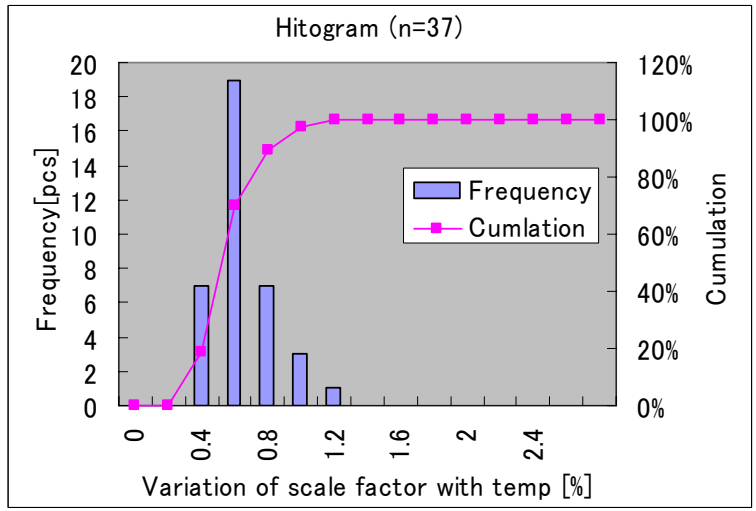
ex. Vcc=5V CCW = (0.300-2.200)*1000/26.75 = -71.0deg/s

Characteristics (Temperature stability)





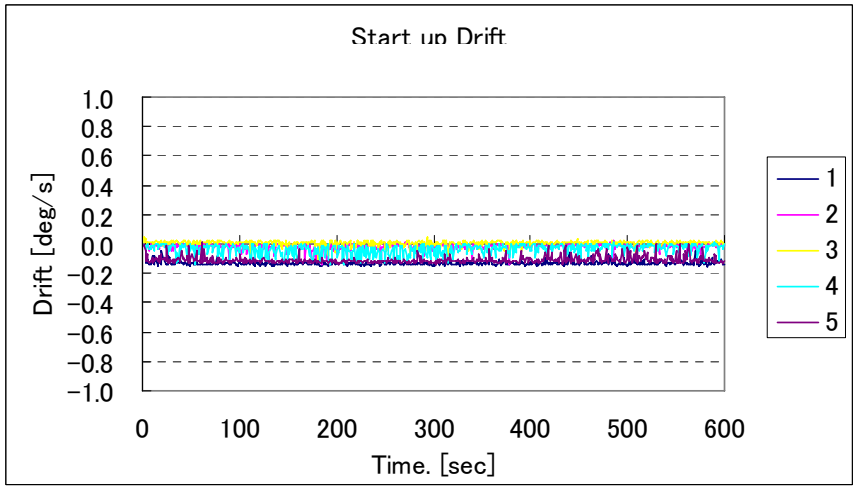


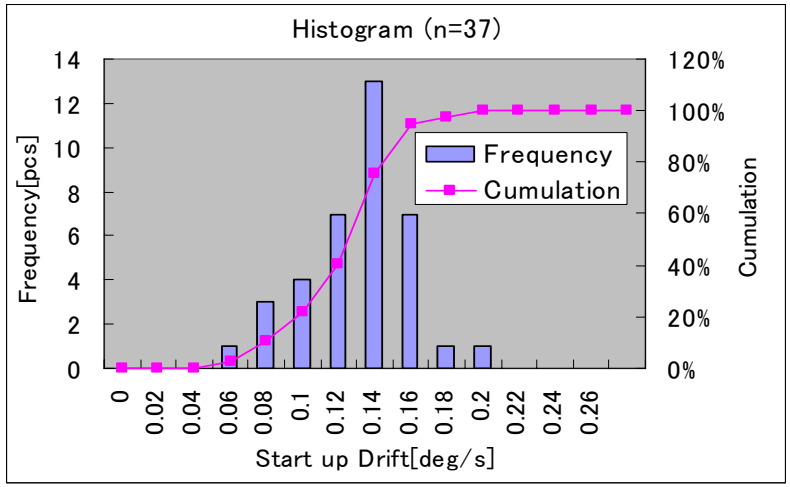


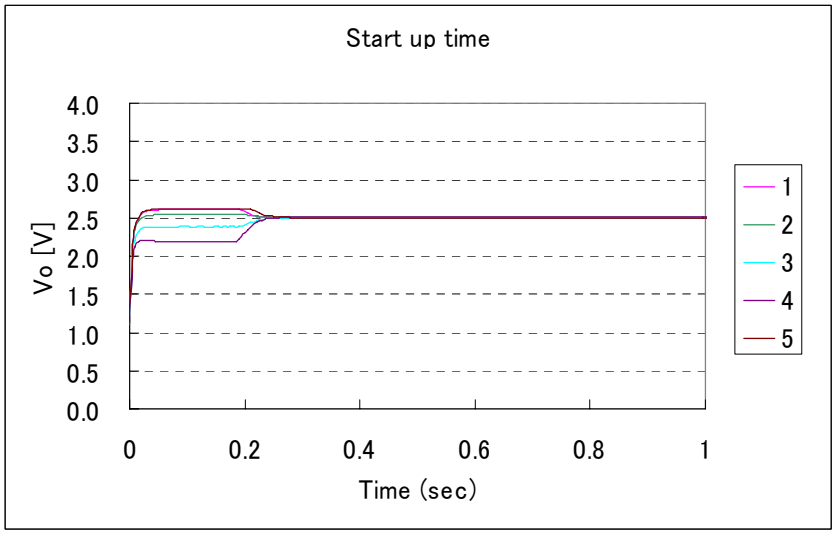
Note) Reference only

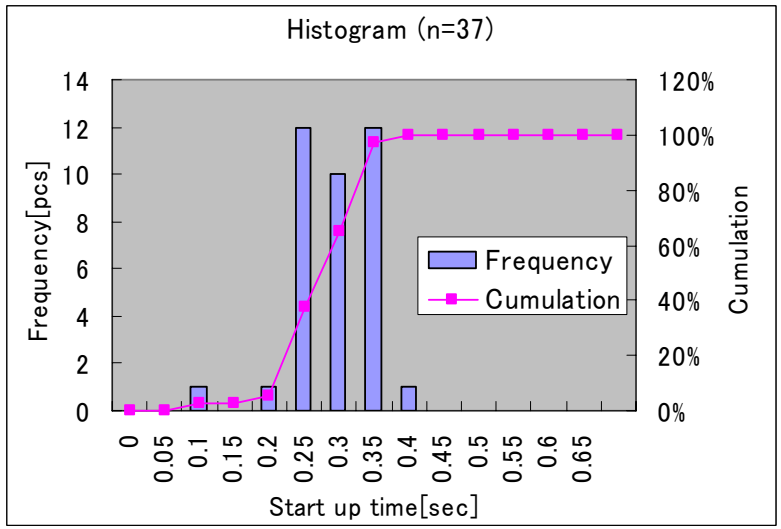
Confidential

Characteristics (Start up stability)









Note) Reference only

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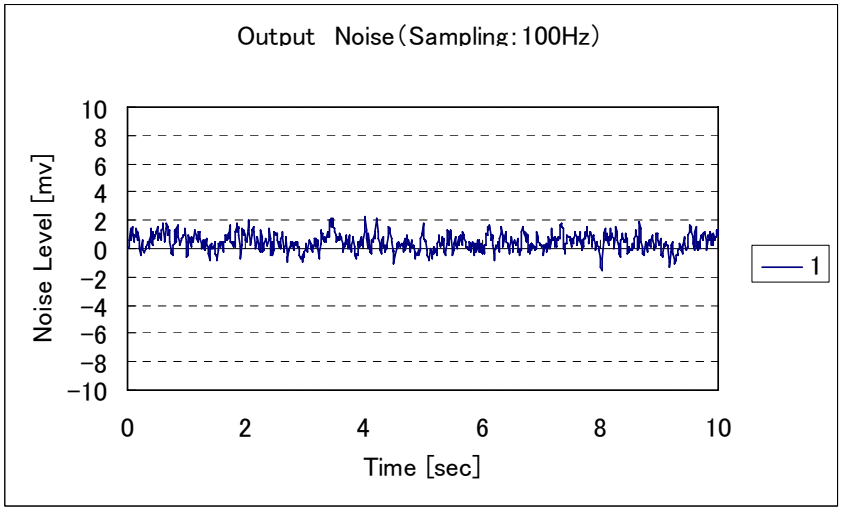
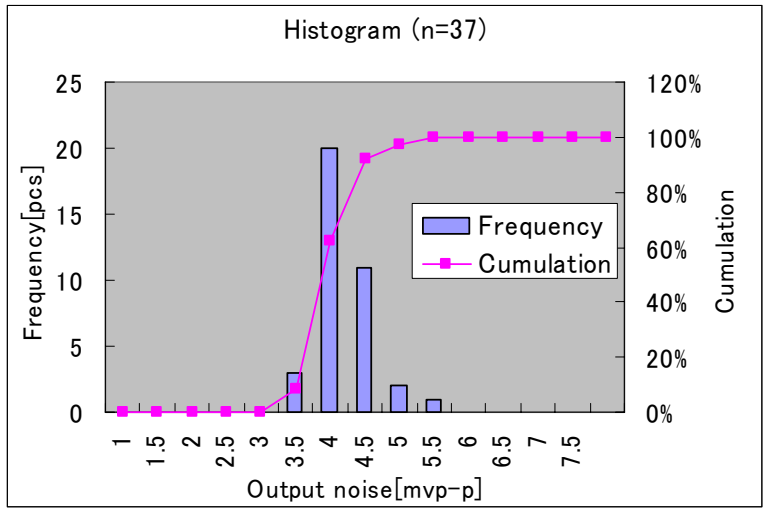
Characteristics (Output Noise, Over all)





	Temperature drift deg/s	Variation of scale factor %	Start up drift deg/s	Start up time sec	Output noise mVp-p
AVG	0.60	0.53	0.12	0.27	3.92
σ	0.27	0.21	0.03	0.06	0.41
max	1.42	1.17	0.20	0.38	5.28
min	0.26	0.21	0.06	0.06	3.08

	Tem. drift Gradient deg/s/2℃	Tem. drift Gradient deg/s/8℃
AVG	0.13	0.20
σ	0.01	0.05
max	0.15	0.34
min	0.12	0.13

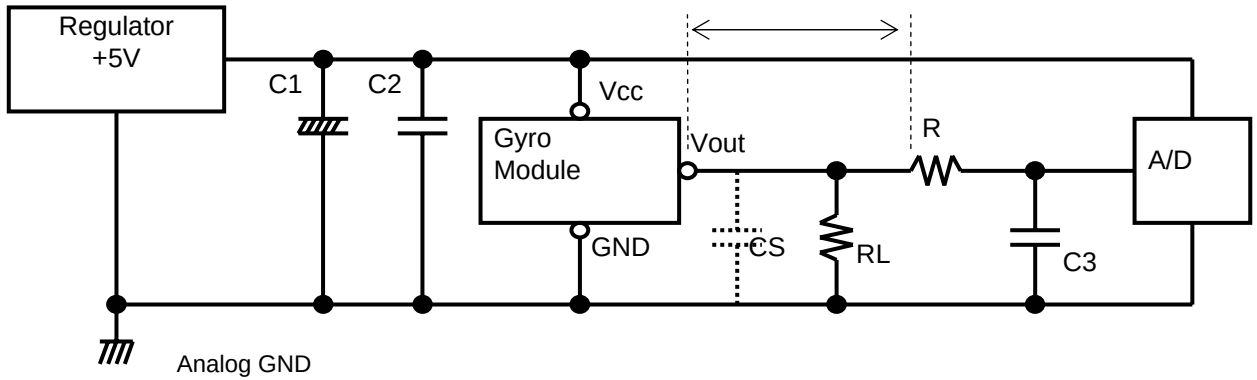
N=37

Temperature Rang: -40 to 85 degC

Note) Reference only

Recommendable external circuit information

RL and R must be placed to the Vout terminal as closely as possible.



C1, C2:

C1 and/or C2 is for noise elimination purpose on a power supply line used in the system. Please choose appropriate value for that.

RL:

RL must be used as a load resistor of 100k ohm (or over).

Cs:

Please do NOT connect a parallel capacitor ”Cs” to the VOUT terminal of gyro. In case Cs is necessarily used, please make sure that the total capacitance never exceed 15pF, that may include stray capacitance possibly appeared on a signal line in between VOUT and A/D converter.

R:

The stray capacitance might relatively increase, as the line-distance in between VOUT and A/D gets longer. If it will be totally 15pF or over, a series resistor ”R” should be used to effectively reduce such a stray capacitance. R should better be mounted as closely as possible to VOUT, and must be one thousandth or less of input impedance of A/D. For the reference, R=2k ohm is recommended.

C3:

C3 may be used to eliminate a high frequency noise, but please note that a low-pass filter, which is made by a combination of R and C3, causes phase delay, in other words, delay on response characteristic.

Thank you very much for your attention!