

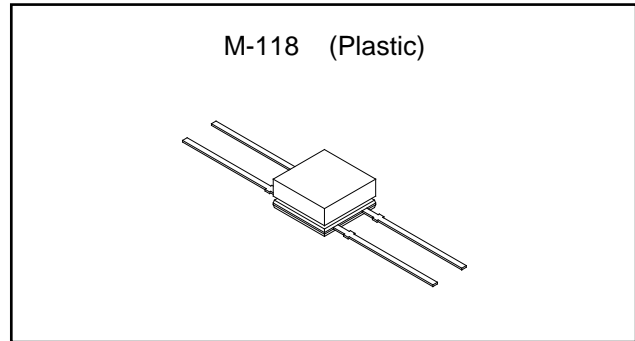
## Magnetoresistance Element

**Description**

DM-232 a magnetic sensor using magnetoresistance effect is composed of ferromagnetic material deposited by evaporation on a silicon substrate. It is suitable for angle of rotation detection.

**Features**

- Low magnetic field and high sensitivity: bridge type stands for large output voltage  
150 mVp-p (Min.) at  $V_{CC}=5\text{ V}$ ,  $H=14400\text{ A/m}$
- Fitted with bias magnet: stable output.
- High reliability: Achieved through silicon nitride protective film.



**Structure**

Ferromagnetic thin film circuit (With ferrite magnet)

**Applications**

- Non-contact angle of rotation detection.
- Contactless potentiometer.

**Absolute Maximum Ratings** ( $T_a=25\text{ }^\circ\text{C}$ )

- Supply voltage  $V_{CC}$  10 V
- Storage temperature  $T_{stg}$   $-30$  to  $+100\text{ }^\circ\text{C}$

**Recommended Operating Conditions**

- Supply voltage  $V_{CC}$  5 V
- Operating temperature  $T_{opr}$   $-20$  to  $+75\text{ }^\circ\text{C}$

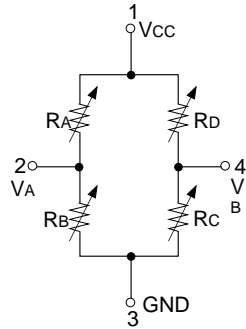
**Electrical Characteristics**

$T_a=25\text{ }^\circ\text{C}$

| Item   | Symbol                    | Condition   | Min.  | Typ. | Max.  | Unit     |
|--|---------------------------|---|-------|------|-------|----------|
| Output voltage                               | $V_O$                     | $V_{CC}=5\text{ V}$ , $H=14400\text{ A/m}$ (Peak)<br>AC magnetic field $\theta = 0^\circ$ | 150   |      |       | mVp-p    |
| Midpoint potential                           | $V_A, V_B$                | $V_{CC}=5\text{ V}$ , $H=0\text{ A/m}$  | 2.475 |      | 2.525 | V        |
| Midpoint potential difference/Output voltage | $\frac{ V_A - V_B }{V_O}$ | $V_{CC}=5\text{ V}$ , $H=0\text{ A/m}$  |       |      | 15    | %        |
| Total resistance                             | $R_T$                     | $H=14400\text{ A/m}$ (Peak)<br>AC magnetic field $\theta = 0^\circ$                       | 500   | 650  | 800   | $\Omega$ |

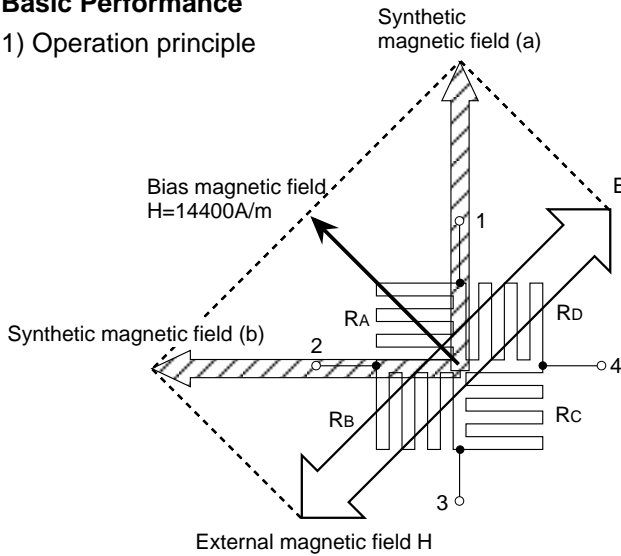
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**Equivalent Circuit**



**Basic Performance**

1) Operation principle

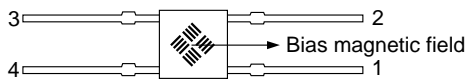


External magnetic field H

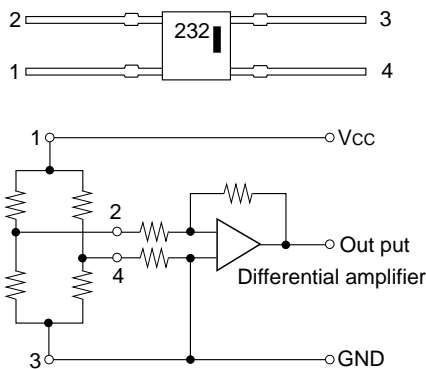
Various resistances change according to the direction of the combined bias and external magnetic field.

- i) When the direction of the synthetic magnetic field is (a),  
 RA, RC : Minimum resistance  
 RB, RD : Maximum resistance
- ii) When the direction of the synthetic magnetic field is (b),  
 RA, RC : Maximum resistance  
 RB, RD : Minimum resistance

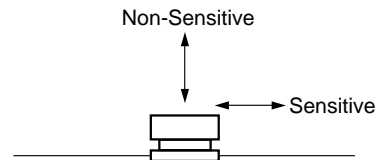
\* Device internal structure  
(Back of mark face)



2) Power supply pin and output pin



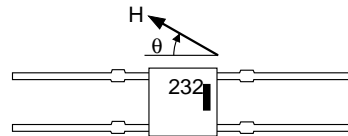
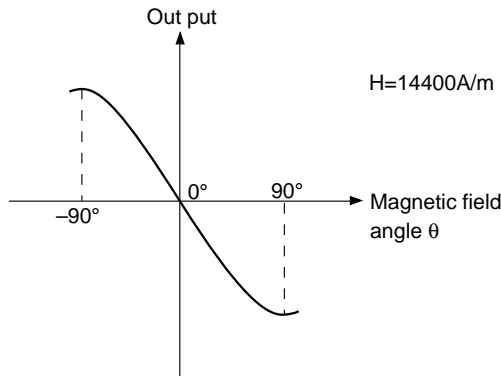
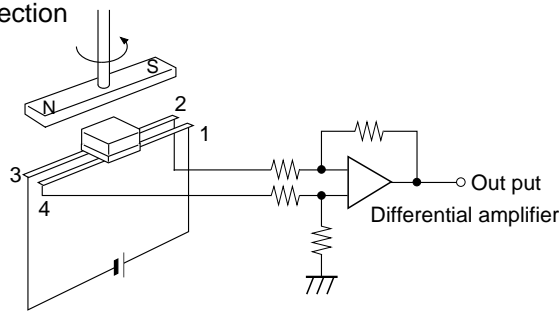
3) Sensitivity direction



The ferromagnetic magnetoresistance element differs from the semiconductor magnetoresistance element in that it responds only to the magnetic field within the element's surface. It is not sensitive to the magnetic field perpendicular to the element.

**Basic Application**

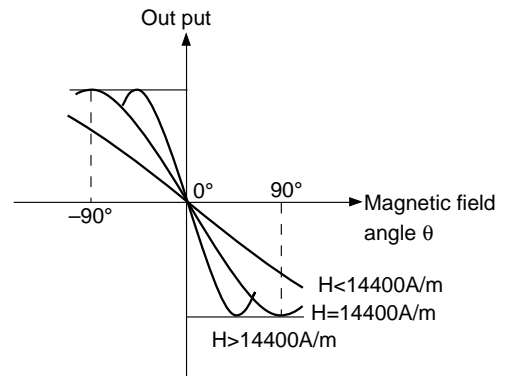
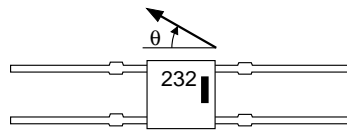
Rotation angular detection



**Handling precautions**

1) Most suitable magnetic field intensity

When the external magnetic field is at  $H=14400A/m$ , rotation angle can be detected most effectively.



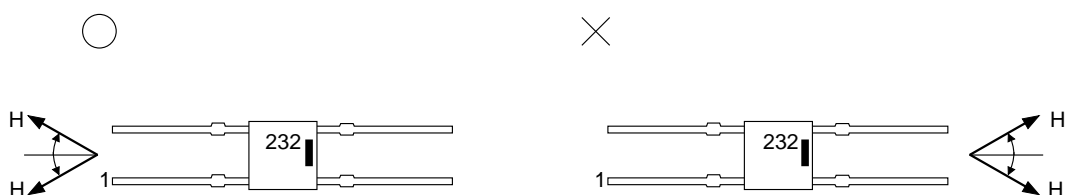
When the external magnetic field  $H<14400A/m$ , output voltage shrinks.

When the external magnetic field  $H>14400A/m$ , the detection angle range shrinks.

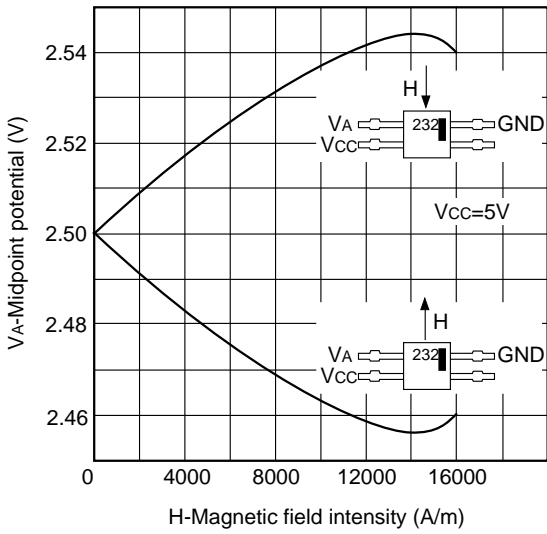
When the external magnetic field  $H<14400A/m$ , the detection angle range becomes larger. In regions other than  $-90^\circ$  to  $+90^\circ$ , the magnetic field combined with the bias magnetic field, shrinks down, which is not advisable. Also, when the range to be detected is smaller than  $-90^\circ$  to  $+90^\circ$  it is more advantageous to turn to  $H>14400A/m$ .

2) External magnetic field direction

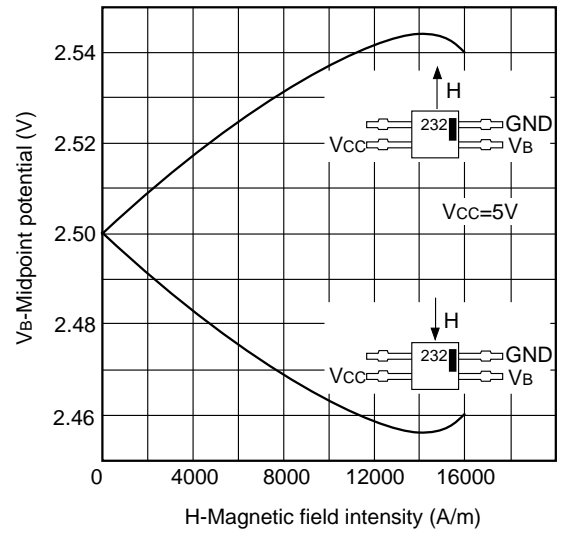
With regards to the bias magnetic field, usage at other than  $\pm 90^\circ$  should be avoided. That causes a decrease in the combined magnetic field intensity, that is not recommended.



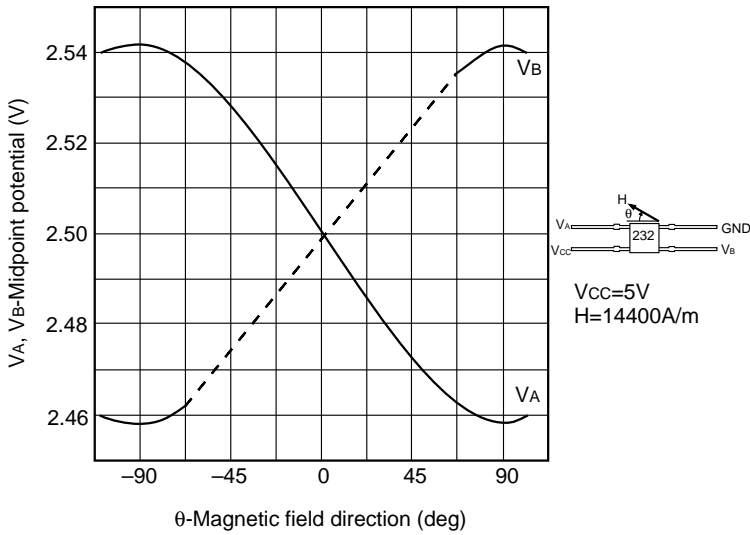
Midpoint potential vs. Magnetic field Intensity (1)



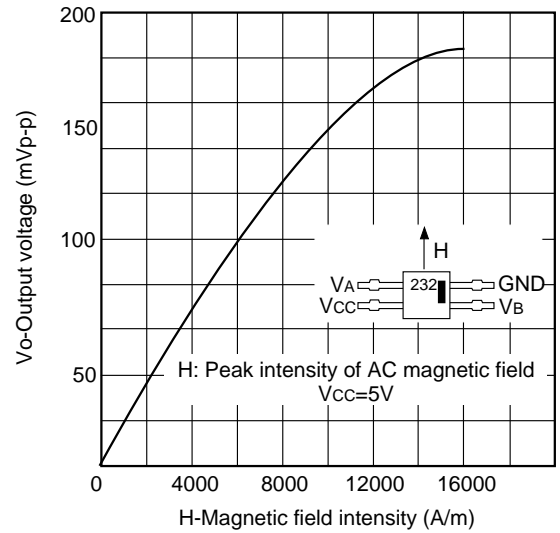
Midpoint potential vs. Magnetic field Intensity (2)



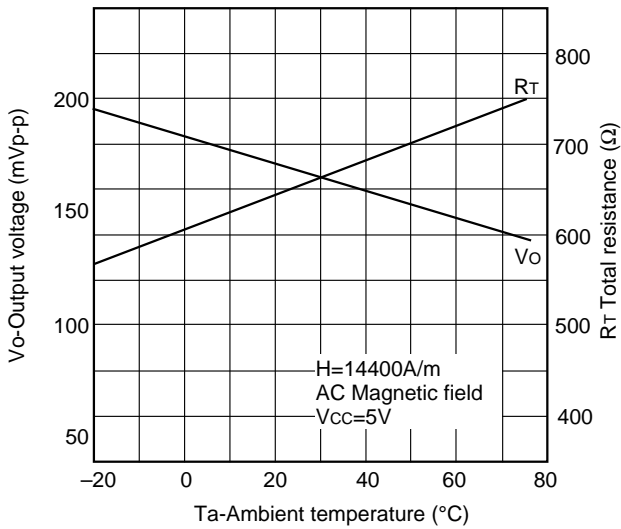
Midpoint potential vs. Magnetic field direction



Output voltage vs. Magnetic field intensity

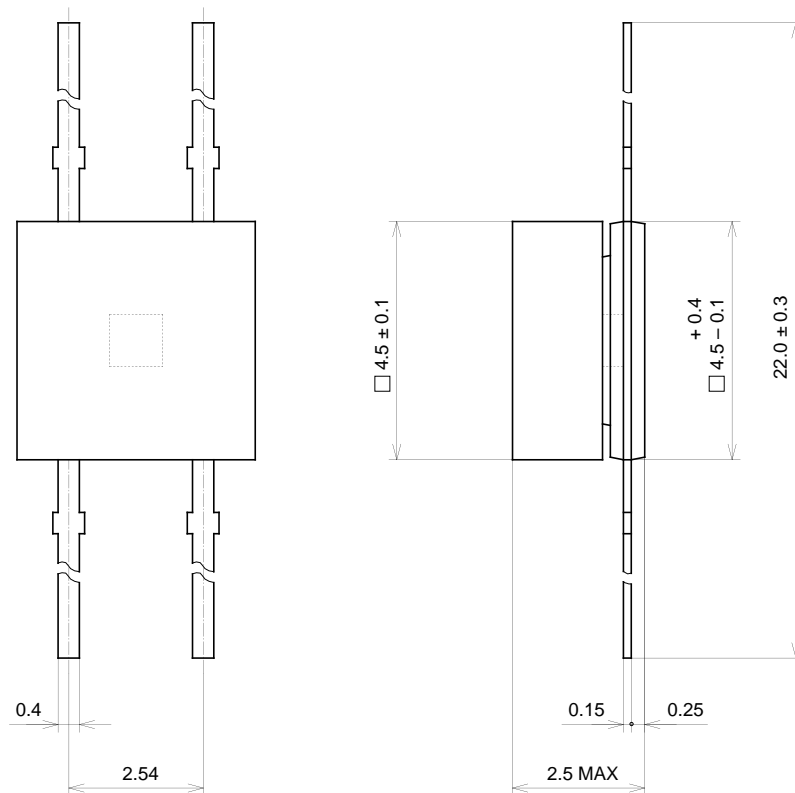


Temperature characteristics



Package Outline Unit : mm

M-118



|            |       |
|------------|-------|
| SONY CODE  | M-118 |
| EIAJ CODE  | _____ |
| JEDEC CODE | _____ |

|                |      |
|----------------|------|
| PACKAGE WEIGHT | 0.2g |
|----------------|------|