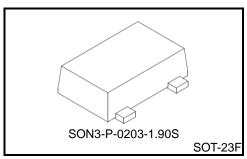
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TCS40DPR

#### Digital Output Magnetic Sensor

#### **Feature**

Push-Pull Output
South-Pole and North-Pole Detection

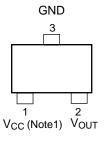


Weight: 11.0 mg (typ.)

#### Marking



### **Pin Assignment (Top View)**



#### **Function Table**

| Magnetic Flux<br>Density | Output |  |  |  |
|--------------------------|--------|--|--|--|
| $\geq B_{ON}$            | L      |  |  |  |
| ≤ Boff                   | Н      |  |  |  |

Note 1: A  $0.47~\mu F$  capacitor should be connected near the device. This condition will not guarantee successful operation. Check the performance thorough evaluation using the actual application to set the condition.

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

| Characteristics           | Symbol           | Rating      | Unit |
|---------------------------|------------------|-------------|------|
| Supply Voltage            | Vcc              | V           |      |
| Output Voltage            | Vout             | −0.5 to 6.0 | V    |
| Output Diode Current      | lok              | ±10         | mA   |
| Output Current            | lout             | ±5          | mA   |
| Vcc/GND Current           | Icc              | ±10         | mA   |
| Power Dissipation         | PD               | 1 (Note 2)  | W    |
| Storage Temperature Range | T <sub>stg</sub> | −65 to 150  | °C   |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: Mounted on a FR4 board.

 $(25.4 \text{ mm} \times 25.4 \text{ mm} \times 1.6 \text{ mm}, \text{ Cu Pad: } 645 \text{ mm}^2)$ 

#### **Operating Ranges**

| Characteristics       | Symbol    | Rating               | Unit |
|-----------------------|-----------|----------------------|------|
| Supply Voltage        | Vcc       | 2.3 to 5.5           | V    |
| Output Voltage        | Vout      | 0 to V <sub>CC</sub> | V    |
| Output Current        | IOH / IOL | ±1.0                 | mA   |
| Operating Temperature | Topr      | -40 to 85            | °C   |

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## DC Characteristics (Ta = 25°C)

| Characteri     | stics                | Symbol | Condition                                       | V <sub>CC</sub> (V) | Min | Тур. | Max  | Unit |
|----------------|----------------------|--------|---|---------------------|-----|------|------|------|
|                | High Level           | Vон    | I <sub>OH</sub> = −1.0 mA                       | 2.3                 | 2.0 | _    | -    |      |
|                |                      |        |   | 2.5                 | 2.2 | 1    | 1    |      |
|                |                      |        |   | 3.3                 | 2.9 | 1    | 1    |      |
|                |                      |        |   | 3.6                 | 3.2 | -    | -    |      |
| Output Voltage |                      |        |   | 5.0                 | 4.5 | 1    | 1    | V    |
| Output Voltage |                      | VoL    | I <sub>OL</sub> = 1.0 mA                        | 2.3                 | _   | 1    | 0.23 | V    |
|                | Low Level            |        |   | 2.5                 | _   | 1    | 0.25 |      |
|                |                      |        |   | 3.3                 | _   | 1    | 0.33 |      |
|                |                      |        |   | 3.6                 | _   | 1    | 0.36 |      |
|                |                      |        |   | 5.0                 | _   | _    | 0.50 |      |
|                | Average<br>Current   | Icc    | Current at pulse<br>driving<br>(Note 3, Fig. A) | 2.3                 | _   | 7.3  | 13.2 | μΑ   |
| Supply Current |                      |        |   | 2.5                 | _   | 8.5  | _    |      |
|                |                      |        |   | 3.3                 | _   | 12.8 | 1    |      |
|                |                      |        |   | 5.0                 | _   | 19.0 | _    |      |
|                | Operating<br>Current | IccON  | Peak current<br>(Note 3, Fig. A)                | 2.3                 | _   | 0.7  | 1.1  | mA   |
|                |                      |        |   | 2.5                 | _   | 0.8  | -    |      |
|                |                      |        |   | 3.3                 | _   | 1.2  | _    |      |
|                |                      |        |   | 5.0                 | _   | 1.6  | _    |      |
| Operating Fre  | quency               | fopr   | (Fig. A)  | 2.3 to 5.0          | _   | 25   | _    | Hz   |

Note 3: Supply current is pulsed periodically by internal circuit.

## **Magnetic Characteristics (Ta = 25°C)**

| Cha                | aracteristics   | Symbol             | Condition<br>(Note 4, Fig. B)       | V <sub>CC</sub> (V) | Min | Тур. | Max | Unit |
|--------------------|-----------------|--------------------|-------------------------------------|---------------------|-----|------|-----|------|
| Magnetic —<br>Flux | Operating Point | BonS               | When output logic turns High to Low | 2.3 to 3.6          | _   | 3.4  | 4.4 |      |
|                    |                 | BonN               |                                     | 5.0                 | _   | 2.8  | 4.4 |      |
|                    | Releasing Point | BOFFS              | When output logic turns Low to High | 2.3 to 3.6          | 0.9 | 2.0  | _   | mT*  |
|                    |                 | B <sub>OFF</sub> N |                                     | 5.0                 | 0.4 | 1.5  | _   |      |
|                    | Hysteresis      | BH                 | Bon - Boff                          | 2.3 to 5.0          | _   | 1.4  | _   |      |

\*1 mT = 10 Gauss

Note 4: Uniform magnetic field perpendicularly to the magnetic sensor.

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Note: Direction of Magnetic field

Magnetic Field, B

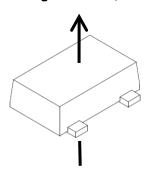


Fig. A: Icc Characteristics

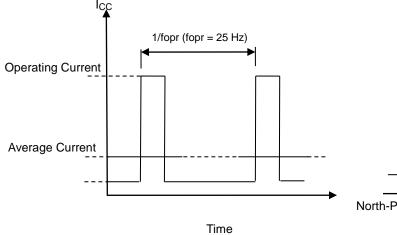
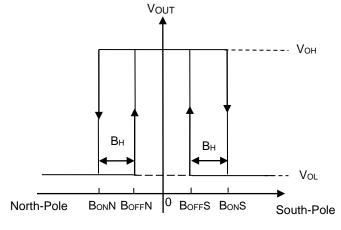


Fig. B: Operating Characteristics

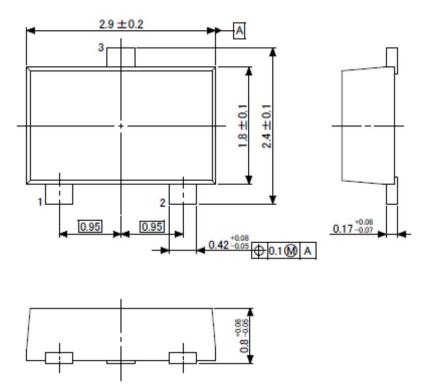


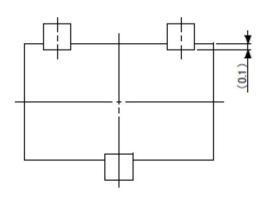
Magnetic Flux Density

## **Package Dimension**

SON3-P-0203-1.90S

Unit: mm

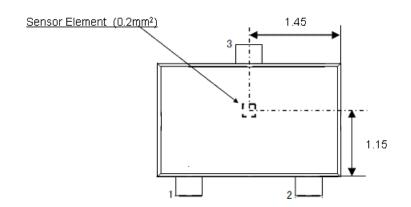


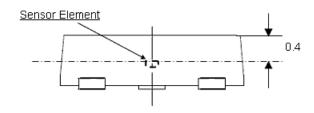


Weight: 11.0 mg (Typ.)

## **Layout of Sensor Element**

Unit: mm





Note: Dimensional tolerances are ±0.1 mm, unless otherwise specified.

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