

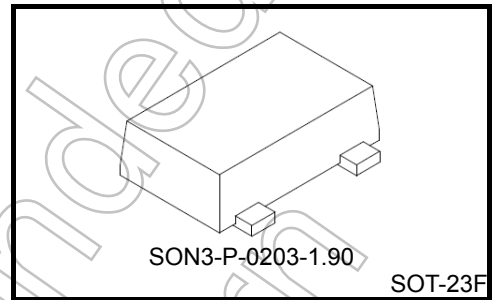
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TCS20DPR

Digital Output Magnetic Sensor

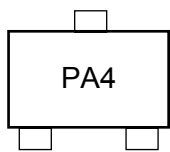
**Feature**

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

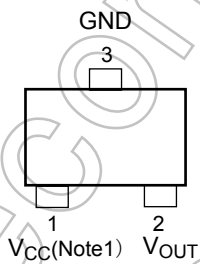


Weight: 11.0 mg (typ.)

**Marking**



**Pin Assignment (Top View)**



**Function Table**

| Magnetic Flux Density | Output |
|-----------------------|--------|
| $\geq B_{ON}$         | L      |
| $\leq B_{OFF}$        | H      |

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.

Start of commercial production  
2010-03

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

| Characteristics              | Symbol           | Rating      | Unit |
|------------------------------|------------------|-------------|------|
| Supply Voltage               | V <sub>CC</sub>  | -0.5 to 6.0 | V    |
| Output Voltage               | V <sub>OUT</sub> | -0.5 to 6.0 | V    |
| Output Diode Current         | I <sub>OK</sub>  | ±10         | mA   |
| Output Current               | I <sub>OUT</sub> | ±5          | mA   |
| V <sub>CC</sub> /GND Current | I <sub>CC</sub>  | ±10         | mA   |
| Power Dissipation            | P <sub>D</sub>   | 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 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm<sup>2</sup>)

## Operating Ranges

| Characteristics       | Symbol                            | Rating               | Unit |
|-----------------------|-----------------------------------|----------------------|------|
| Supply Voltage        | V <sub>CC</sub>                   | 2.3 to 5.5           | V    |
| Output Voltage        | V <sub>OUT</sub>                  | 0 to V <sub>CC</sub> | V    |
| Output Current        | I <sub>OH</sub> / I <sub>OL</sub> | ±1.0                 | mA   |
| Operating Temperature | T <sub>opr</sub>                  | -40 to 85            | °C   |

**DC Characteristics (Ta = 25°C)**

| Characteristics     |                   | Symbol            | Condition                                 | V <sub>CC</sub> (V) | Min | Typ. | Max  | Unit |
|---------------------|-------------------|-------------------|---|---------------------|-----|------|------|------|
| Output Voltage      | High Level        | V <sub>OH</sub>   | I <sub>OH</sub> = -1.0 mA                 | 2.3                 | 2.0 | —    | —    | V    |
|                     |                   |                   |   | 2.5                 | 2.2 | —    | —    |      |
|                     |                   |                   |   | 3.3                 | 2.9 | —    | —    |      |
|                     |                   |                   |   | 3.6                 | 3.2 | —    | —    |      |
|                     |                   |                   |   | 5.0                 | 4.5 | —    | —    |      |
|                     | Low Level         | V <sub>OL</sub>   | I <sub>OL</sub> = 1.0mA                   | 2.3                 | —   | —    | 0.23 |      |
|                     |                   |                   |   | 2.5                 | —   | —    | 0.25 |      |
|                     |                   |                   |   | 3.3                 | —   | —    | 0.33 |      |
|                     |                   |                   |   | 3.6                 | —   | —    | 0.36 |      |
|                     |                   |                   |   | 5.0                 | —   | —    | 0.50 |      |
| Supply Current      | Average Current   | I <sub>CC</sub>   | Current at pulse driving (Note 3, Fig. A) | 2.3                 | —   | 7.3  | 13.2 | μA   |
|                     |                   |                   |   | 2.5                 | —   | 8.5  | —    |      |
|                     |                   |                   |   | 3.3                 | —   | 12.8 | —    |      |
|                     |                   |                   |   | 5.0                 | —   | 19.0 | —    |      |
|                     | Operating Current | I <sub>CCON</sub> | Peak current (Note 3, Fig. A)             | 2.3                 | —   | 0.7  | 1.1  | mA   |
|                     |                   |                   |   | 2.5                 | —   | 0.8  | —    |      |
|                     |                   |                   |   | 3.3                 | —   | 1.2  | —    |      |
|                     |                   |                   |   | 5.0                 | —   | 1.6  | —    |      |
| Operating Frequency |                   | f <sub>opr</sub>  | (Fig. A)                                  | 2.3 to 5.0          | —   | 25   | —    | Hz   |

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

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

| Characteristics          |                 | Symbol            | Condition (Note 4, Fig. B)          | V <sub>CC</sub> (V)                | Min        | Typ. | Max | Unit |   |
|--------------------------|-----------------|-------------------|-------------------------------------|------------------------------------|------------|------|-----|------|---|
| Magnetic Flux Density, B | Operating Point | B <sub>ONS</sub>  | When output logic turns High to Low | 2.3 to 3.6                         | —          | 3.4  | 4.4 | mT*  |   |
|                          |                 | B <sub>ONN</sub>  |                                     | 5.0                                | —          | 2.8  | 4.4 |      |   |
|                          | Releasing Point | B <sub>OFFS</sub> | When output logic turns Low to High | 2.3 to 3.6                         | 0.9        | 2.0  | —   |      |   |
|                          |                 | B <sub>OFFN</sub> |                                     | 5.0                                | 0.4        | 1.5  | —   |      |   |
|                          | Hysteresis      |                   | B <sub>H</sub>                      | B <sub>ON</sub> - B <sub>OFF</sub> | 2.3 to 5.0 | —    | 1.4 |      | — |

\*1 mT=10 Gauss

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

Note : Direction of Magnetic field

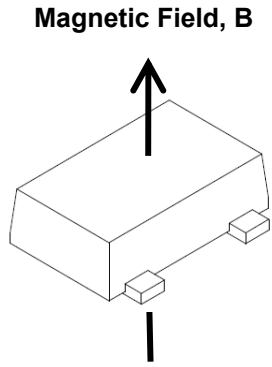


Fig. A :  $I_{CC}$  Characteristics

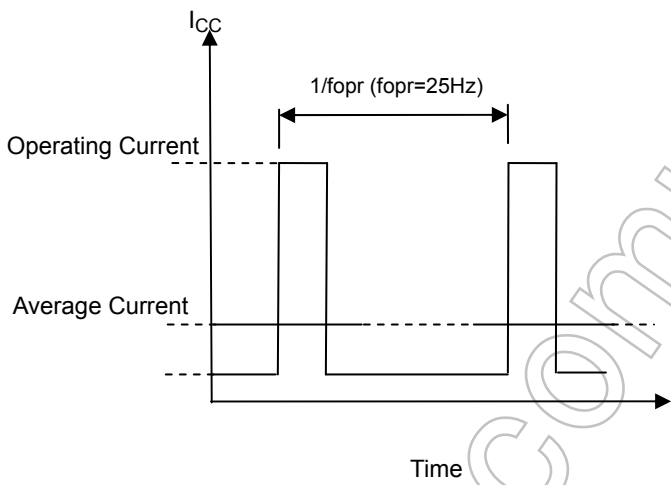
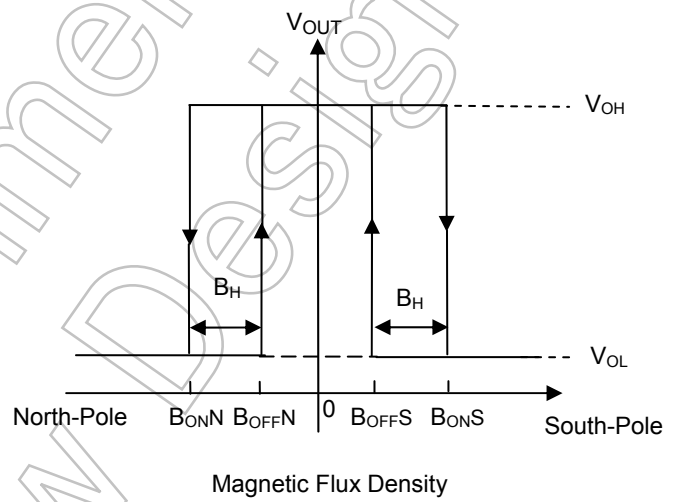


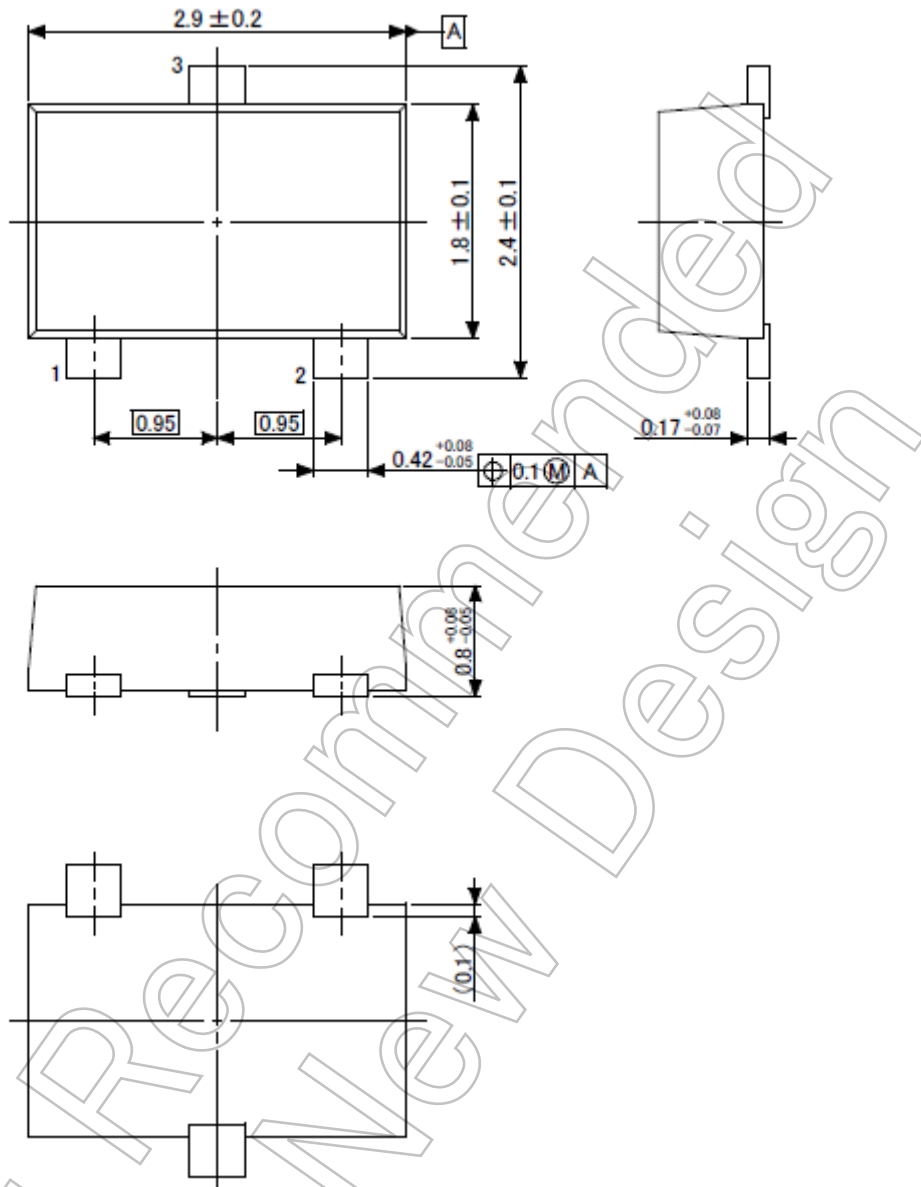
Fig. B : Operating Characteristics



Not Recommended for New Design

Package Dimension

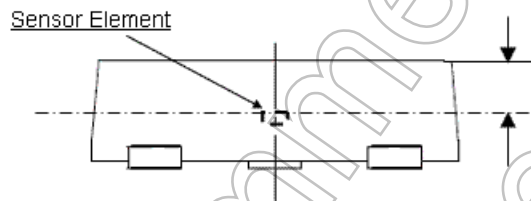
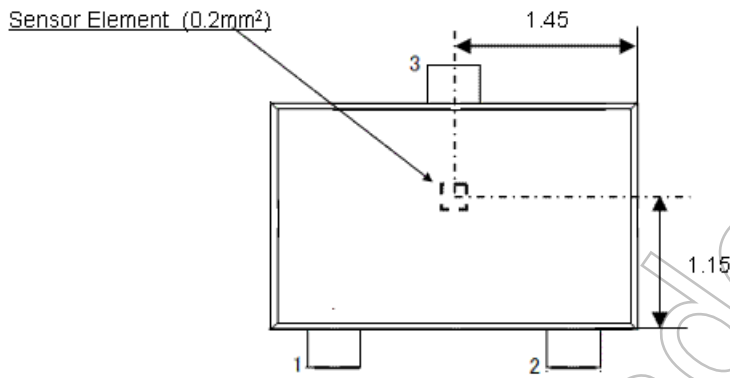
Unit: mm



Weight: 11.0 mg (Typ.)

**Layout of Sensor Element**

Unit: mm



Note: Dimensional tolerances are  $\pm 0.1$  mm, unless otherwise specified.

Not Recommended for New Design

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