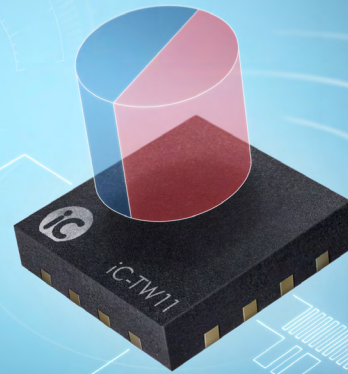


# iC-TW11

## 10-Bit Ultra Low Power Magnetic Absolute Rotary Encoder

ULTRA LOW POWER



### Description

The iC-TW11 is a single-chip magnetic rotary encoder for low-power end-of-shaft applications. It includes three Hall elements, automatic power management features, and offers 10-bit resolution in a space-saving 4 × 4 mm QFN16 package. Built-in automatic gain control (AGC) assures optimum analog-to-digital conversion under all conditions with no setup. A noise filter improves measurement stability, and can be disabled to reduce power consumption.

The iC-TW11 supports a maximum conversion rate of 4 kHz (4000 samples per second) with power consumption proportional to the conversion rate. Low power mode reduces current by a factor of 7 while increasing the maximum sampling rate to 20 kHz. Sampling is initiated over the SPI interface or via a dedicated pin for application versatility.

Communication and control of the iC-TW11 is via a 4-wire SPI interface and multiple devices can be chained together for efficient usage. Absolute position angle, angle-equivalent sine and cosine values, and the three raw Hall element voltages can all be read over the SPI interface allowing both simple and sophisticated applications to be implemented easily.

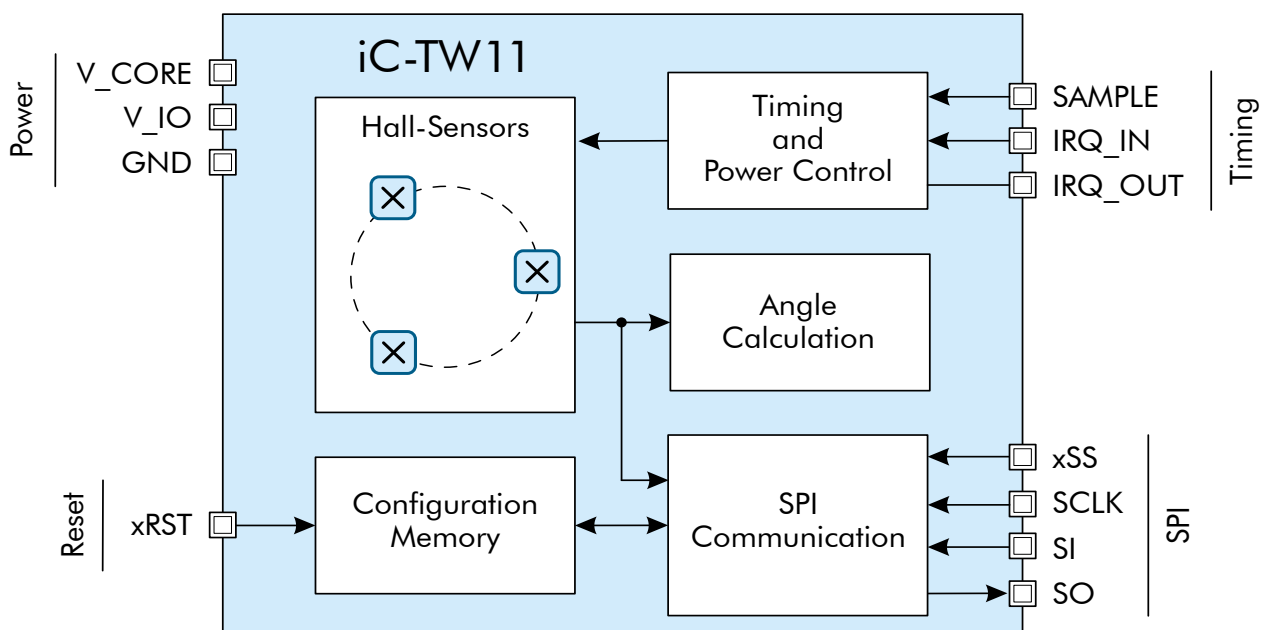
### Features

- 10-bit angle resolution
- Split power supplies for 1.8 V I/O applications
- Sampling initiated via SPI command or dedicated pin
- Interrupt input and output for chaining multiple devices
- Up to 4 kHz sampling frequency
- 21  $\mu\text{A}$  typical supply current at 10 Hz sampling frequency
- Low power mode reduces current to 3  $\mu\text{A}$  at 10 Hz
- Automatic sleep mode draws  $\leq 100 \text{ nA}$  between samples
- Standard 4-wire SPI communication
- Automatic Hall array gain control (AGC)
- Operational temperature range of  $-40 \text{ }^\circ\text{C}$  to  $+125 \text{ }^\circ\text{C}$
- Space-saving, RoHS compliant 4x4 mm QFN16 package

### Applications

- Battery-powered portable equipment
- Digital potentiometers and front panel controls
- Servo or stepper motor feedback
- Assembly robots and autonomous vehicles
- Office equipment and household appliances

### Block Diagram



# iC-TW 11

## 10-Bit Ultra Low Power Magnetic Absolute Rotary Encoder

### Pin Functions

No.	Name	Function
1	TP1	Test Pin
2	TM1	Test Pin
3	TPO	Test Pin
4	TM0	Test Pin
5	SI	SPI Slave Input
6	TESTEN	Test Pin
7	SO	SPI Slave Output
8	IRQ_OUT	Interrupt Output (sample ready)
9	IRQ_IN	Interrupt Input (for chaining multiple devices)
10	SCLK	SPI Slave Clock Input
11	xSS	SPI Slave Select Input (active low)
12	V_IO	I/O Power Input (1.8 V – 3.3 V)
13	SAMPLE	Sample Request Input
14	xRST	Reset Input (active low)
15	V_CORE	Main Power Input (3.3 V)
16	GND	Ground

### Key Specifications

General	
Angle Resolution	10 bit (0.35°; 21 arc-minutes)
Angular Accuracy	+/- 1° typical (+/- 3 LSB)
Supply Voltage (V_CORE)	3.3 V +/- 10 %
I/O Supply Voltage (V_IO)	1.7 V – V_CORE
Supply Current (Sleep Mode)	≤ 100 nA
Magnetic Field Strength	25 – 150 kA/m
ESD Susceptibility	2 kV (HBM 100 pF, 1.5 kΩ)
Operational Temperature	- 40 °C to +125 °C

#### Normal Mode (Filter Enabled)

Sampling Frequency	up to 4 kHz
Conversion Time	225 – 300 μs
Supply Current (1 kHz Sampling)	8.2 mA typical
Supply Current (1 kHz Sampling)	2.0 mA typical
Supply Current (10 Hz Sampling)	21 μA typical

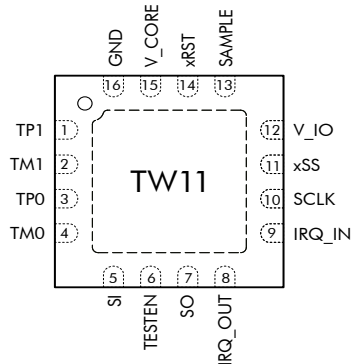
#### Low Power Mode (Filter Disabled)

Sampling Frequency	up to 20 kHz
Conversion Time	40 – 54 μs
Supply Current (20 kHz Sampling)	5 mA typical
Supply Current (1 kHz Sampling)	260 μA typical
Supply Current (10 Hz Sampling)	3 μA typical

#### SPI Communication

Mode	4-wire mode 0 slave
SPI Clock Frequency	16 MHz maximum
Multiple Device Chaining	independent or daisy chain
Available Commands	read 10-bit angle value read 12-bit angle sine value read 12-bit angle cosine value read raw hall sensor voltages read/write configuration registers

### Pin Configuration



### Application Example

