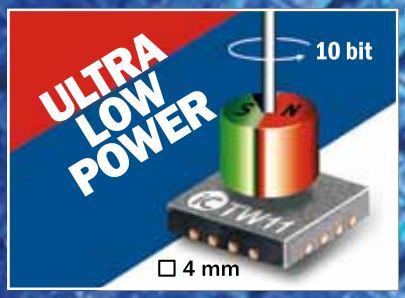
iC-TW11

10-BIT ULTRA LOW POWER MAGNETIC ABSOLUTE ROTARY ENCODER



The iC-TW11 is a single-chip magnetic rotary encoder for low-voltage (1.8 V – 3.3 V) and 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 mm x 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.

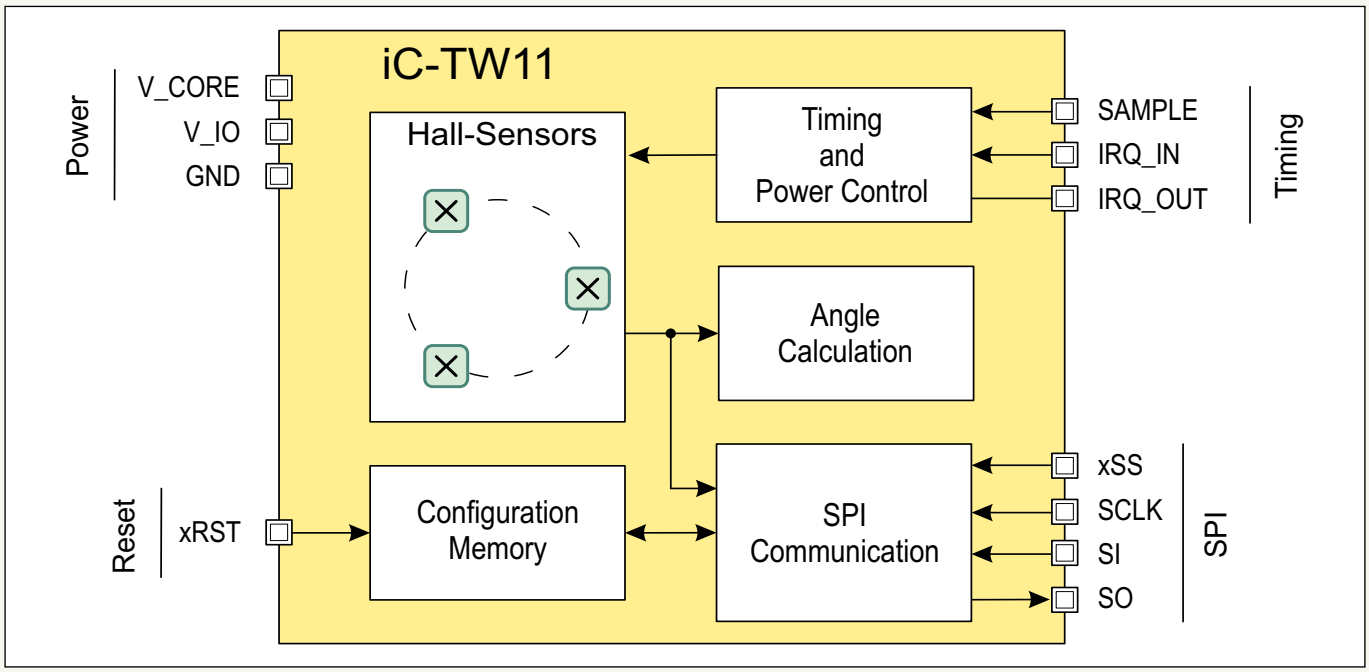
Communication and control of the iC-TW11 is via a 4-wire SPI interface and multiple devices can be chained together for efficient usage. Absolute position angle, angle-equivalent sine and cosine values, and the three raw Hall element voltages can all be read over the SPI interface allowing both simple 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 µA typical supply current at 10 Hz sampling frequency
- Low power mode reduces current to 3 µA at 10 Hz
- Automatic sleep mode draws ≤ 100 nA between samples
- Standard 4-wire SPI communication
- Automatic Hall array gain control (AGC)
- Operational temperature range of -40 °C to +125 °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



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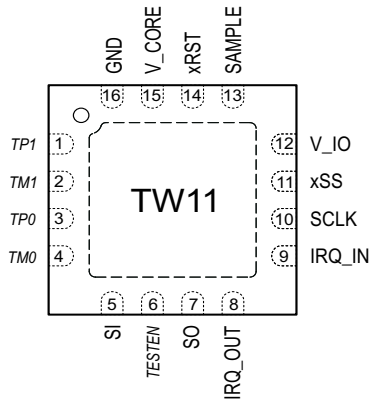
iC-TW11 10-BIT ULTRA LOW-POWER MAGNETIC ROTARY ENCODER

Pin Functions

No.	Name	Function
1	TP1	Test Pin
2	TM1	Test Pin
3	TP0	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

Pin Configuration QFN16 4 mm x 4 mm



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 (4 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

Application Example