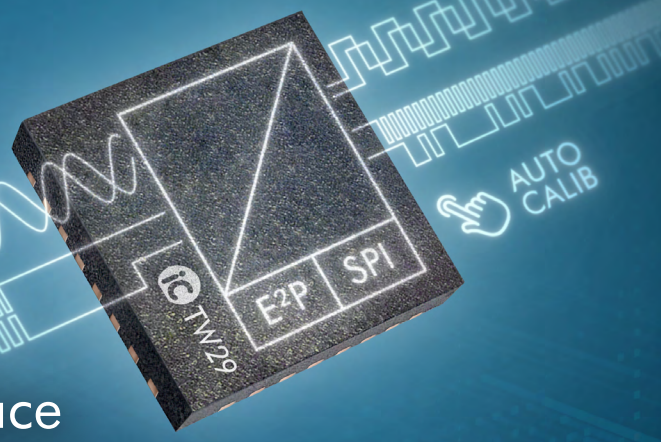
iC-TW29

26-Bit Encoder Processor With Interpolation And BiSS Interface



Description

The iC-TW29 is a system-on-chip for encoder applications. The integration of a high-resolution interpolator with a 26-bit gearbox provides a complete solution for arbitrary resolution single and multiturn encoders.

Independent I/O modules with individually programmed resolutions provide BiSS C, ABZ, or UVW outputs separately or in combination. Automatic calibration of sensor offset, sin/cos amplitude and phase, and zero input offset, gain, and phase provide and maintain minimum angular error and jitter. The gearbox tracks input cycles (up to 4,096 per revolution) and provides output resolutions of up to 26 bits per revolution. Auto-calibrated eccentricity compensation increases achievable angular accuracy by correcting for off-center optical discs or magnetic polewheels. When combined with an external revolution counter, the iC-TW29 provides a complete BiSS multiturn absolute encoder solution.

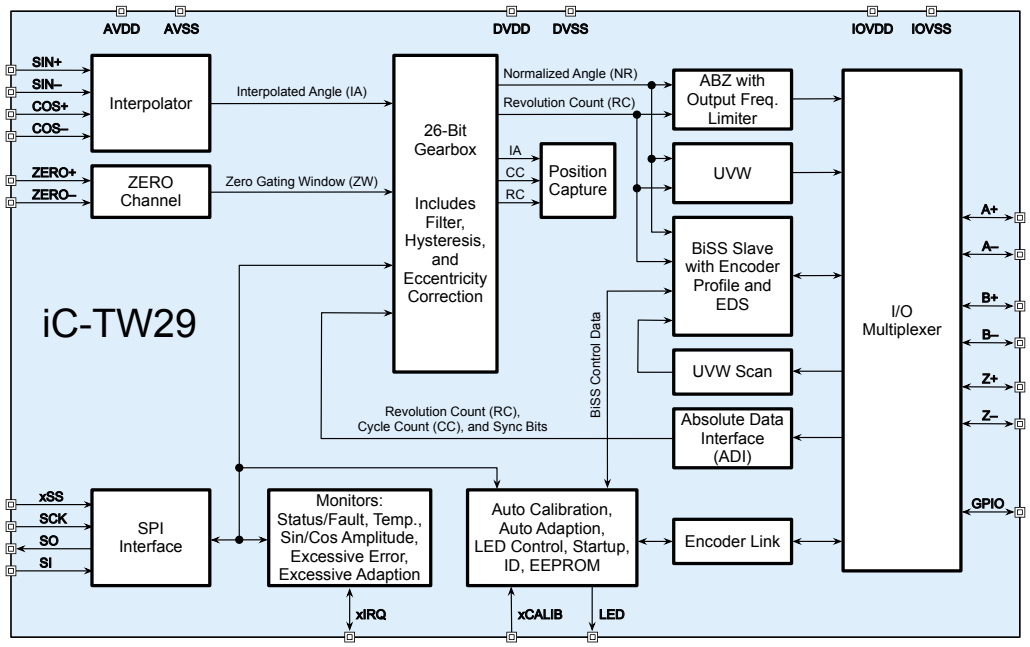
Applications

- Rotary and linear incremental and absolute encoders
- Magnetic or optical sin/cos sensor interface
- Brushless motor commutation

Features

- Any output resolution with any input resolution
- Independently-programmed ABZ, UVW, and BiSS resolutions
- Absolute data interface for external revolution counters
- BiSS Interface with built-in Encoder Profiles (BiSS C with profiles 3, 3S, 4, and EDS SE, or custom)
- 26-bit singleturn position and 32-bit revolution count via SPI
- Four capture registers for coded reference marks and touch-probe applications
- Eccentricity compensation
- Input frequency up to 700 kHz
- AB output frequency up to 12.5 MHz
- Differential RS422 line driver outputs for ABZ or UVW
- Simultaneous single-ended outputs for ABZ, UVW, BiSS
- Automatic compensation of amplitude, offset, and phase errors
- Digital filtering for ultra-low output jitter
- Encoder Link™ interface for in-field re-configuration
- Internal EEPROM and oscillator
- LED intensity control by PWM output
- Low, constant latency (2.4 µs or 5.0 µs)
- Pin-compatible with iC-TW28

Block Diagram



iC-TW29
26-Bit Encoder Processor

Key Specifications

Inputs	
Power Supply	3.1 to 3.6 V, 30 mA typical
Input Frequency	700 kHz maximum
Input Signal Amplitude	20 mV to 2 V differential in 2 ranges
Zero Input Amplitude	0 ... 3.3 V differential
Sin/Cos Gain Range	−3 ... 40.5 dB in 1.5 dB steps

Signal Conditioning	
S/C Offset Correction	±25% of input in 0.02% steps
Sin/Cos Balance Corr.	±25% of input in 0.02% steps
Sin/Cos Phase Corr.	±26° in 0.02° steps
Auto Calibration	Sin/Cos offset, gain, balance, phase Zero offset, gain, phase Eccentricity

Sin/Cos Interpolator	
Position Update Rate	50 MHz
Accuracy (INL)	+/− 0.2°
Jitter (DNL)	+/− 0.1°
Noise and Jitter Filter	Configurable PI servo loop
Angle Hysteresis	0 to 4.92 output degrees
Effective Resolution	16 bits per input period minimum

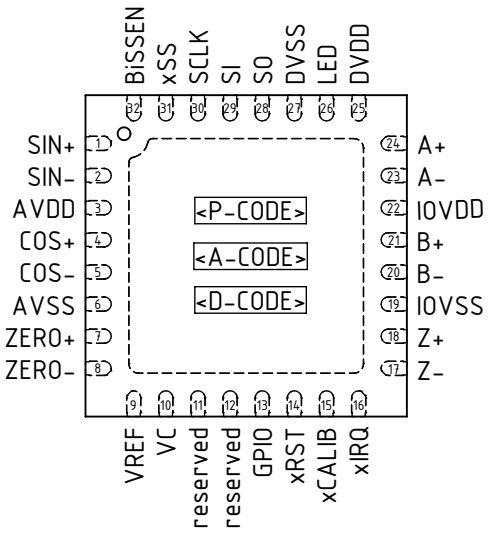
ABZ / UVW Output Signals	
AB Resolution	1 ... 2^{18} cycles per revolution
Max. AB Frequency	12.5 MHz
Min. AB Edge Distance	20 ns to 20 µs
Z Index Width	90°, 180°, or 360° of an AB cycle
UVW Resolution	1 to 32 UVW cycles per revolution
Driver Configuration	Push-pull (CMOS) differential or single-ended, or RS-422

BiSS Interface	
Encoder Profile	BP3, BP3S (Safety), BP4, EDS SE, or custom (with external µP)
Singleturn Resolution	4 ... 2^{26} increments per revolution
Multiturn Count	0 ... 32 bits in 4 bit increments
SCDS Feedback Bits	2 (nE, nW), 3, or 8
Max. Clock Frequency	10 MHz

Advanced Features

- Jump compensation allows BiSS operation prior to absolute position synchronization
- UVW scan mode for motor commutation via BiSS
- Built-in temperature sensor and programmable alarm
- Enhanced mode SPI for faster communication
- Common-mode shift accomodates 2.5V common-mode signals
- Two additional general-purpose discrete I/O on unused pins
- Low-power reset mode for standby draws only microamps

Package QFN32-5×5



Pin Functions

Name	Function
SIN+, SIN−	Differential Sensor Sine Inputs
AVDD	3.3V Analog Power Supply Input
COS+, COS−	Differential Sensor Cosine Inputs
AVSS	Analog Ground
ZERO+, ZERO−	Differential Zero Sensor Inputs
VREF, VC	ADC Reference and Bias Voltage Outputs
GPIO	General Purpose Discrete I/O
xRST	Reset Input (active low)
xCALIB	Calibration Input (active low)
xIRQ	Interrupt Request I/O (active low)
Z+, Z−	Differential Z Outputs or Multifunction I/O
IOVSS	I/O Ground
B+, B−	Differential B Outputs or Multifunction I/O
IOVDD	3.3 V I/O Power Supply Input
A+, A−	Differential A Outputs or Multifunction I/O
DVDD	3.3 V Digital Power Supply Input
LED	LED Intensity Control Output or GPIO
DVSS	Digital Ground
SO	SPI Slave Output
SI	SPI Slave Input
SCLK	SPI Clock Input
xSS	SPI Slave Select Input
BISSEN	BiSS Interface Enable

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