

iC-TW28

10-Bit Low-Latency Sin/Cos Interpolator With Auto-Calibration And Line Driver

Description

The iC-TW28 is a low-latency (1.5 μ s) application-specific interpolator for sine/cosine signals. It provides differential ABZ or UVW outputs via a built-in RS422 line driver or simultaneous single-ended ABZ and UVW outputs in a 5x5 mm QFN32 package. Automatic calibration of the signal path parameters and adaption during operation provides and maintains minimum angular error and jitter. A configurable signal path filter provides dynamic response characteristics, allowing smooth outputs as well as fast response to changing inputs.

Suitable for stand-alone or hosted operation, the iC-TW28 is configured by dedicated pins, SPI communication, or Encoder Link. The Encoder Link interface uses the A+ and A- outputs for SPI-like communication for configuration or re-configuration in the field.

A built-in LED controller allows controlling the intensity of an optical sensor's LED to maintain optimum input signal amplitudes despite ageing or changes in operational conditions. Complete status monitoring and fault detection capabilities with a dedicated LED driver or interrupt request pin for implementing safety functions are provided. In hosted applications, a 14-bit multicycle counter is available which can be extended using a host processor. A capture register allows coded index and touch-probe applications.

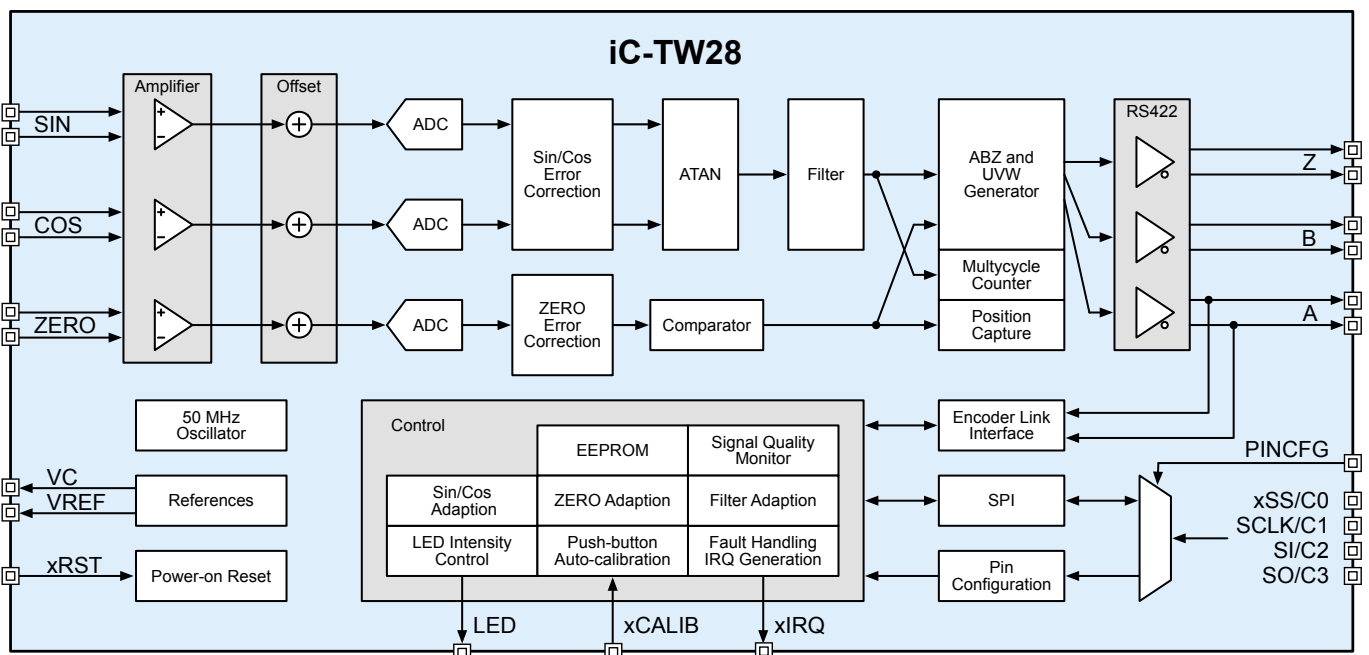
Features

- Easy to use – built-in line driver, EEPROM, and oscillator
- Push-button automatic calibration for fast commissioning
- 3.3 V operation from -40 ... 125 °C for rugged applications
- Complete status and fault monitoring capabilities
- Encoder Link interface for field diagnostics and configuration

Applications

- Rotary and linear encoders
- Magnetic or optical sin/cos sensor modules
- High-output magnetic sensor (GMR, TMR) encoder
- Brushless motor commutation (2 ... 64 poles)
- Fast imbedded motion controller

Block Diagram



iC-TW28

10-Bit Sin/Cos Interpolator With Auto-Calibration

Key Specifications

Inputs	
Power	3.1 ... 3.6V, 25 mA typical
Max. Sin/Cos Frequency	700 kHz
Sin/Cos Inputs Signal Amplitude	10 mV ... 2V (using input divider)
Zero Input Signal Amplitude	10 mV ... 3.3V
Gain	-3 ... 40.5 dB in 1.5 dB steps

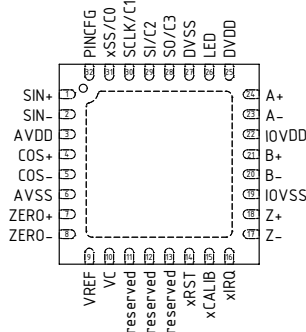
Signal Conditioning (Error Correction)	
Sin/Cos Offset Correction	±25% of signal in 0.2% steps
Sin/Cos Balance Correction	±25% of signal in 0.2% steps
Sin/Cos Phase Correction	±26° in 0.22° steps
Auto-Calibration	Sin/cos offset, gain, balance, phase Zero offset, gain, phase

Sin/Cos to Digital Angle Conversion	
Sampling Frequency	3.125 megasamples/second
Upsampling (interpolation)	≤ 50 megasamples/second
Integral Nonlinearity	0.7°
Differential Nonlinearity	0.35°
Filter	Configurable PI servo loop

Outputs	
AB Interpolation	0.25 ... 256 AB cycles per input cycle
Max. AB Output Frequency	50 kHz ... 12.5 MHz
Min. AB Edge Separation	20 ns ... 5 μs
UVW Interpolation	1 ... 32 UVW cycles per input cycle
AB and UVW Hysteresis	0 ... 10.9°
Z Output Width	1 ... 16 AB quadrature states
Driver Configuration	RS422 or CMOS differential Single-ended CMOS (ABZ and UVW)
Post-AB Divider	1/1 ... 1/8 UVW
Input-to-Output Latency	1.5 μs
Output Lag	0.8 μs
LED Intensity Control	0 ... 15 mA

Interface and Communication	
SPI	4-Wire Mode 0 Slave, 20 MHz
Encoder Link	Field programmable
Pin Configuration	No programming required

Package QFN32-5x5



Pin Functions

No.	Name	Function
1	SIN+	+ Differential Sine Input
2	SIN-	- Differential Sine Input
3	AVDD	3.3 V Analog Power Supply Input
4	COS+	+ Differential Cosine Input
5	COS-	- Differential Cosine Input
6	AVSS	Analog Ground
7	ZERO+	+ Differential Zero (Index) Input
8	ZERO-	- Differential Zero (Index) Input
9	VREF	ADC Reference Voltage Output
10	VC	VDD/2 Output
14	xRST	Reset Input (active low)
15	xCALIB	Auto-Calibration Input (active low)
16	xIRQ	Interrupt Request/Fault Output (active low)
17	Z-	Differential RS422 Z- or W- Output
18	Z+	Differential RS422 Z+ or W+ Output
19	IOVSS	I/O Ground
20	B-	Differential RS422 B- or V- Output
21	B+	Differential RS422 B+ or V+ Output
22	IOVDD	3.3V I/O Power Supply Input
23	A-	Differential RS422 A- or U- Output
24	A+	Differential RS422 A+ or U+ Output
25	DVDD	3.3V Digital Power Supply Input
26	LED	LED Intensity Control Output
27	DVSS	Digital Ground
28	SO/C3	SPI Slave Output or Configuration Input 3
29	SI/C2	SPI Slave Input or Configuration Input 2
30	SCLK/C1	SPI Clock Input of Configuration Input 1
31	xSS/C0	SPI Slave Select Input or Configuration Input 0
32	PINCFG	Pin Configuration Select Input

Typical Stand-Alone Application

