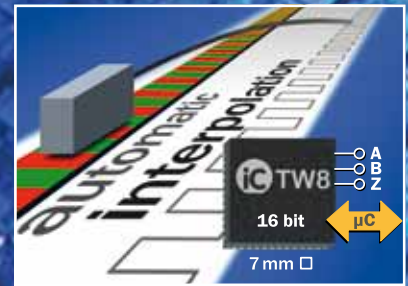


iC-TW8

16-BIT SIN/COS INTERPOLATOR WITH AUTO-CALIBRATION



The iC-TW8 is a 16-bit application-specific DSP interpolator for sine/cosine signals with automatic calibration and adaption of signal path parameters during operation to maintain minimum angular error and jitter. Angular position is calculated at a programmable resolution of up to 65,536 increments per input cycle.

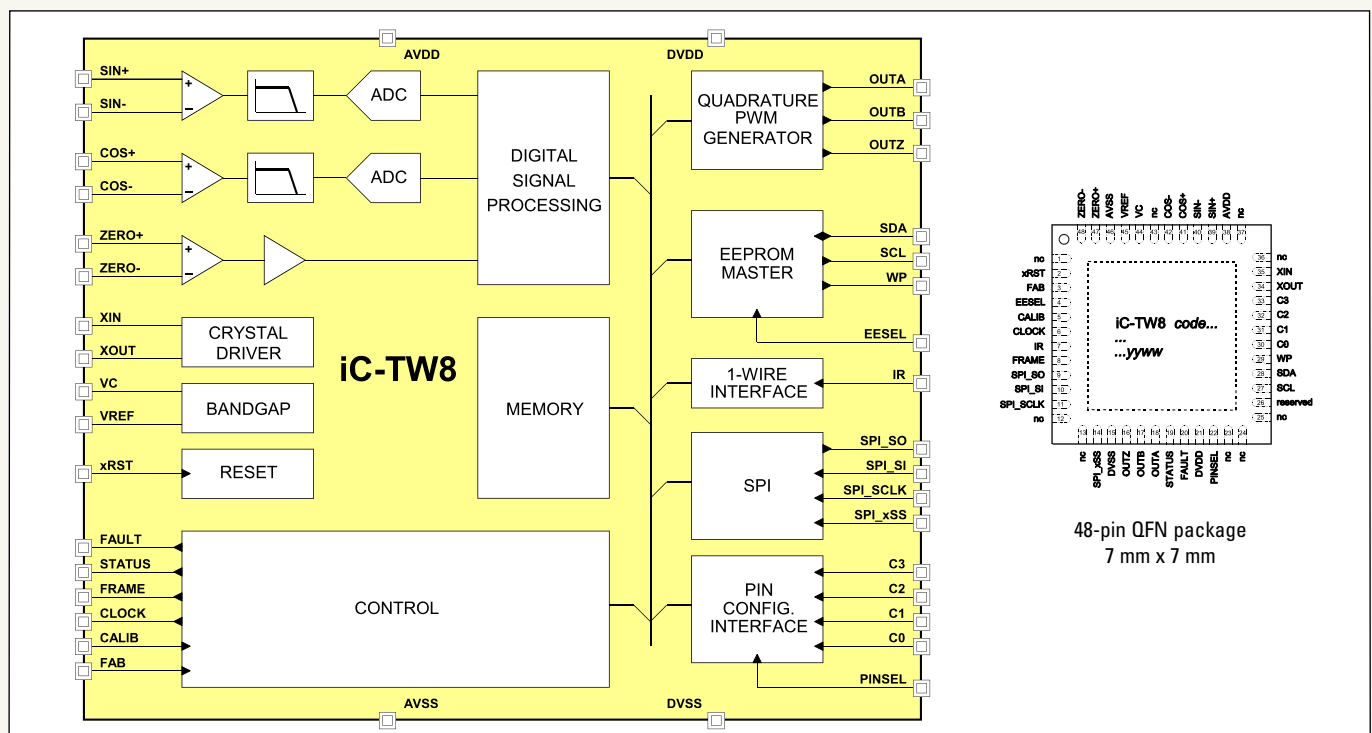
Automatic calibration and adaption (correction during operation) of sensor offset, sine/cosine amplitude match, and phase quadrature is provided. Additionally, a 64-byte lookup table (LUT) is available to correct for residual harmonic distortion in the sensor signals.

Features

- Input frequency of up to 125 kHz
- Differential sine/cosine input signal range of 20 mV to 1.4 V peak-peak
- Binary/decimal interpolation factors from x0.25 to x16384
- Post-AB divider [1/1 to 1/32] allows fractional resolution
- Simple automatic one-pin calibration
- Easy configuration: by static pins (for generic ABZ output)
- Advanced configuration: 1-wire interface, 3 and 4-wire SPI (32 MHz), serial I²C EEPROM
- PWM or ABZ quadrature encoder output signals
- Incremental ABZ output to 8 MHz (32 MHz edge separation)
- Position and velocity read-out (32 bit SPI)
- Sophisticated error handling and signal monitoring
- Static 64 position LUT to compensate for arbitrary sensor distortions
- Supply voltage range of 3.1 V to 5.5 V
- Extended temperature range of -40 °C to +125 °C

Applications

- Sine/cosine interpolation
- Signal conditioning with auto calibration
- Linear and rotary encoders
- Flexible incremental encoder systems



In addition to incremental ABZ quadrature output, the iC-TW8 provides optional PWM (potentiometer) and serial-only (SPI or 1-wire) output modes.

The iC-TW8 offers two configuration modes. Pin configuration mode does not require any programming or calibration and uses a subset of the iC-TW8's complete capabilities. Serial configuration mode allows complete device configuration using the bi-directional SPI or 1-wire serial ports.

One-button auto calibration sets input gain and compensates sensor offset and sin/cos channel gain match and phase with just a few input cycles and then stores the compensation values to EEPROM.

Pin Functions QFN48 7x7 mm²

Name	No.	I/O	Function
xRST	2	in	Reset Input
FAB	3	in	Test Enable Input
EESEL	4	in	External EEPROM Selection Input
CALIB	5	in	Calibration Control
CLOCK	6	in/out	Clock Output
IR	7	in/out	1-Wire Interface I/O
FRAME	8	in/out	Sync Output
SPI_S0	9	out	SPI Slave Output
SPI_SI	10	in	SPI Slave Input
SPI_SCLK	11	in	SPI Slave Clock Input
SPI_xSS	14	in	SPI Slave Select Input
DVSS	15	ground	Digital Ground
OUTZ	16	out	Z Output
OUTB	17	out	B Output / PWM- Outp. / Z Window
OUTA	18	out	A Output / PWM+ Outp. / Z Window
STATUS	19	out	PWM Status Output
FAULT	20	out	Error Status Output
DVDD	21	power	+3.1 V to +5.5 V Dig. Power Supply
PINSEL	22	in	Configuration Mode Selection
SCL	27	in/out	I2C Clock Line
SDA	28	in/out	I2C Data Line
WP	29	out	I2C Write Protection
CO...C3	30...33	a/d	Static Configuration Input
XOUT	34	a	Crystal Terminal
XIN	35	a	Crystal Terminal
AVDD	38	power	+3.1 V to +5.5 V Analog Pwr. Supply
SIN+	39	a	Sine Input +
SIN-	40	a	Sine Input -
COS+	41	a	Cosine Input +
COS-	42	a	Cosine Input -
VC	44	a	Bias Output
VREF	45	a	Bias Output
AVSS	46	ground	Analog Ground
ZERO+	47	a	Zero Input +
ZERO-	48	a	Zero Input -

NB: a: analog; a/d: analog/digital

Key Specifications

Inputs and Analog Signal Conditioning	
Max. Input Frequency	125 kHz
Diff. Input Signal Range	20 mVpp to 1.4 Vpp (differential)
Sin/Cos Input Signal Range	1.4 V to AVDD - 1 V
Analog Gain Range	6 to 45 dB, step 3 dB (auto. tracking)
Analog Offset Compensation	+/- 3.1 V, step 100 mV (auto. tracking)
Zero Inputs Signal Range	0 V to AVDD

Digital Sin/Cos Signal Conditioning	
Offset Correction	+/- 125 mV, step 244 μ V (auto. tracking)
Offset Correction Range	+/- 9 % of amplitude
Differential Gain Correction	x0.8 to x1.25, step x0.002 (auto. track.)
Ampl. Mismatch Corr. Range	+/- 25 % of amplitude
Digital Phase Correction	+/- 26°, step 0.025° (auto. tracking)

Sine-to-Digital Conversion	
Sampling Rate	max 250 kHz at 5 V (187 kHz at 3.3 V)
ATAN Calculation	14 bit raw, 16 bit filtered
Integral Nonlinearity	0.08°
Differential Nonlinearity	0.02°
Distortion Compensation	64 arbitrary positions by look-up-table
Dist. Compensation Range	+/- 11°

Incremental Outputs	
Interpolation Factor	x0.25 ... x16384
Post-AB Divider	1/1 ... 1/32
Output Signals	A/B quadrature, programmable index Z
Output Characteristics	TTL/CMOS compatible, +/- 4 mA
Max. Output Frequency	programmable 62 kHz to 8 MHz
Min. Transition Distance	progr. 4 μ s to 31.25 ns @ fclk 32 MHz
Input-To-Output Latency	24 μ s / 4 μ s with lag recovery
Output Noise/Jitter Filtering	adjustable PI servo loop

Absolute Position Data	
Angle Position	32 bit (with 16 bit for counted periods)
Angle Velocity	14 bit (up to \pm 45 M°/s, 5.4 k°/s resol.)

Interface and Configuration	
Configuration Storage	external I2C 24xx02 EEPROM
SPI	standard SPI, SCLK up to 32 MHz
1-Wire	PWM interface for in-field wireless configuration (e.g. using IR)
Static 4-Pin Configuration	by 8 resistors, no programming
Offset/Gain/Phase Calibration	push-button automatic with storage of parameters in external EEPROM

Other Operational Data	
Supply Voltage	3.1 V to 5.5 V, approx. 15 mA (@ 3.3 V)
Operational Temperature	-40 °C to +125 °C
System Clock	On-chip RC 16 MHz to 32 MHz, crystal to 32 MHz (24 MHz @ 3.3 V)
Monitoring Functions	missing EEPROM, checksum, compromised input signals, excessive AB frequency, runaway of compensation

This preliminary information is not tantamount to a guarantee of device characteristics. All rights to technical changes reserved.