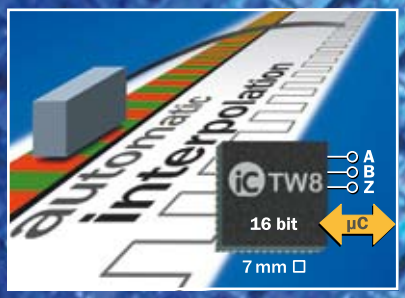
iC-TW8

16-BIT SIN/COS INTERPOLATOR WITH AUTO-CALIBRATION



iC-TW8 is a general-purpose, 16-bit interpolation device for sine/cosine signals featuring automatic signal conditioning. The angular position is calculated at a constant latency of just 24 µs and can be tracked by an optional second-order servo loop that provides lag retrieval.

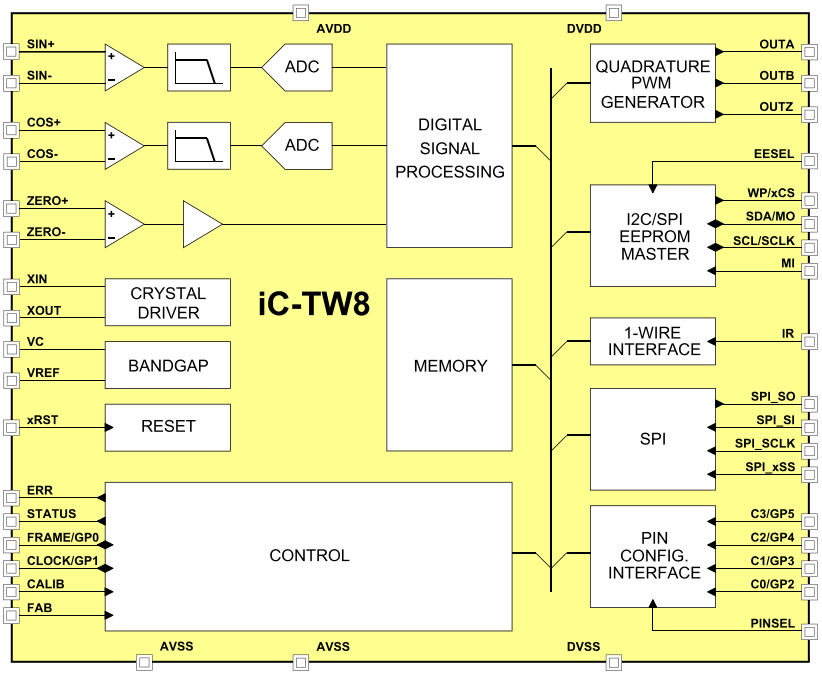
The automatic signal conditioning unit includes offset compensation, amplitude correction, and phase correction. Additionally, an LUT can be used to correct the digitized phase angle depending on the sensor's harmonic signal distortion.

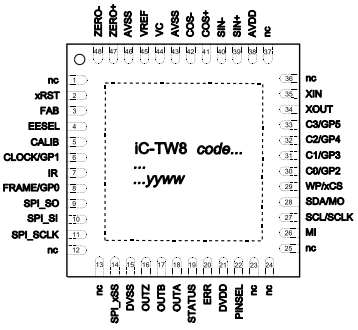
Applications

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

Features

- Input frequency of up to 125 kHz
- Differential sine/cosine input signal range of 20 mV to 1.4 V peak-peak
- Fractional interpolation factor edged per period of [8 ... 65536] / [1 ... 32]
- 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), EEPROM (SPI or I²C)
- 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





48-pin QFN package
7 mm x 7 mm

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Novel push-button calibration

iC-TW8 offers two principle means of setup: easy static pin configuration and the SPI/1-wire interface. Static pin configuration is provided with simple automatic calibration and ABZ quadrature output mode. It uses four configuration inputs and is preselected by input PINSEL.
The self-learning automatic function requires input signals of a few seconds only and tolerates changes in frequency and cw/ccw direction. For more advanced setup requirements the SPI interface or the 1-wire interface can be used to take full control of the device.

Pin Functions QFN48 7x7 mm²

Function	Pin	I/O	Description
xRST	2	in	Reset Input
FAB	3	in	Test Enable Input
EESEL	4	in	External EEPROM Selection Input
CALIB	5	in	Calibration Control
CLOCK/GP1	6	in/out	Clock Output / General Purpose I/O
IR	7	in/out	1-Wire Interface I/O
FRAME/GP0	8	in/out	Sync Output / General Purpose I/O
SPI_SO	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
ERR	20	out	Error Status Output
DVDD	21	power	+3.1 V to +5.5 V Dig. Power Supply
PINSEL	22	in	Configuration Mode Selection
MI	26	in	SPI EEPROM Master Input
SCL/SCLK	27	in/out	I2C / SPI Clock Line
SDA/MO	28	in/out	I2C / SPI Data Line
WP/xCS	29	out	I2C Write Prot. / SPI Slave Selection
Cx/GPx	30...33	a/d	Static Config. Input / GPIO
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 -
AVSS	43	ground	Analog Ground
VC	44	a	Bias Output
VREF	45	a	Bias Output
AVSS	45	ground	Analog Ground
ZERO+	46	a	Zero Input +
ZERO-	47	a	Zero Input -
NB: a: analog; a/d: analog/digital			

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

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 µV (auto. tracking)
Offset Correction Range	+/- 9 % of amplitude
Differential Gain Correction	x0.8 to x1.25, step x0.002 (auto. track.)
Amplit. 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	
Fractional Interpolation Factor	[8 ... 65536] / [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 µs to 31.25 ns @ fclk 32 MHz
Input-To-Output Latency	24 µs
Input-To-Output Lag	4 µs with position lag retrieval
Other Features	servo loop for superb AB jitter

Absolute Position Data	
Angle Position	32 bit (with 16 bit for counted periods)
Angle Velocity	14 bit (up to ±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 EEEPROM, checksum, compromised input signals, excessive AB frequency, runaway of compensation

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