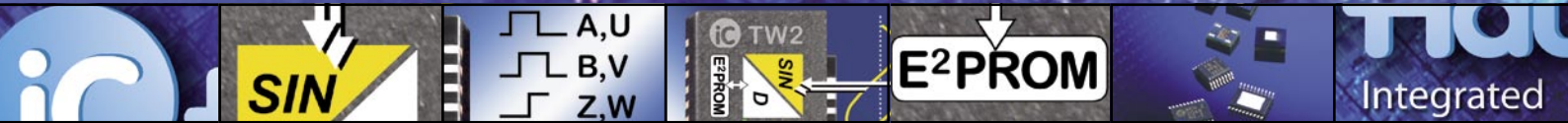
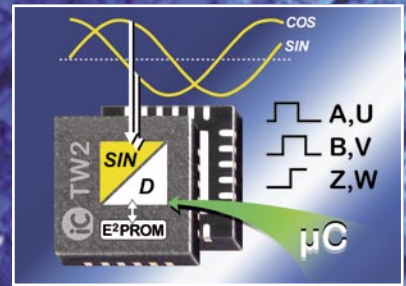


iC-TW2

8-BIT SIN/COS INTERPOLATION IC WITH INTEGRATED EEPROM



iC-TW2 is a configurable interpolation and signal conditioning device featuring encoder quadrature and motor commutation output signals. The chip includes an on-chip EEPROM for permanent storage of setup and calibration parameters and is accessible via serial microcontroller interfaces. The chip operates on single-ended supplies of 3.3 V and 5 V.

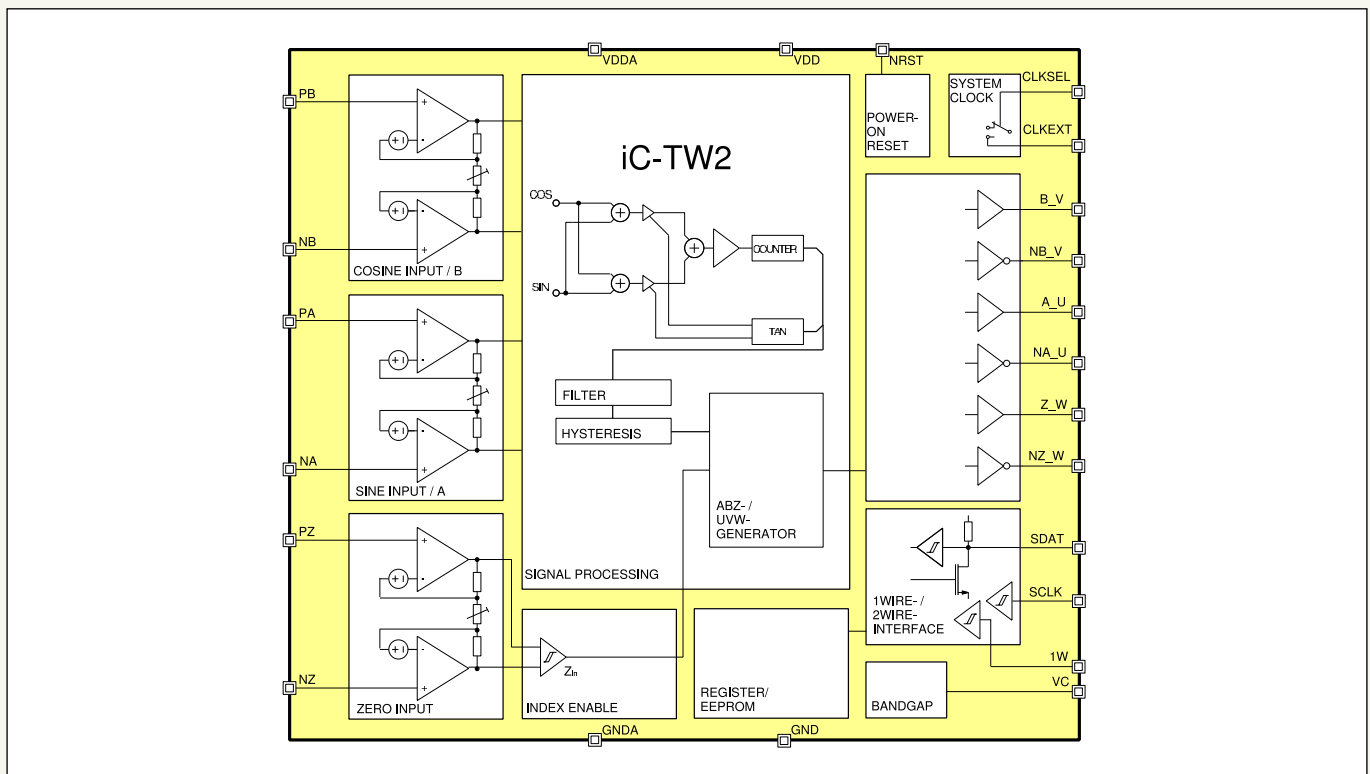
The interpolation engine interfaces differential sensor bridges with no external components required. Single-ended sensor signals are supported by tying the negative input to the signal reference, usually VDD/2.

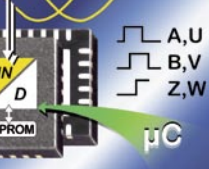
Applications

- Optical and magnetic position sensors
- Rotary encoders
- Linear encoders

Features

- Programmable real-time interpolation
- Freely selectable interpolation factors of x0.25 to x64 (resolution from 1 to 256 angle steps)
- Differential inputs and programmable instrumentation amps
- Selectable gain permits single-ended and differential signals (10 mVpp to 1.5 Vpp)
- Input frequency to 115 kHz at highest resolution
- Four incremental output modes: encoder quadrature with index, up/down clock, increment/direction, 3-phase commutation
- Easy microcontroller access via SPI and single-wire interface
- Single-ended supply of 3.3 V and 5 V, low power consumption
- No external components required for sensor interface, signal calibration, filtering or EEPROM
- Reduced board space due to small QFN package (4x4 mm)





iC-TW2 8-BIT SIN/COS INTERPOLATION IC WITH INTEGRATED EEPROM

iC-TW2 has a large offset correction range and therefore requires no external trimming of the used reference signal.

The index inputs accept a differential or single-ended input signal when using a further reference as the switch threshold.

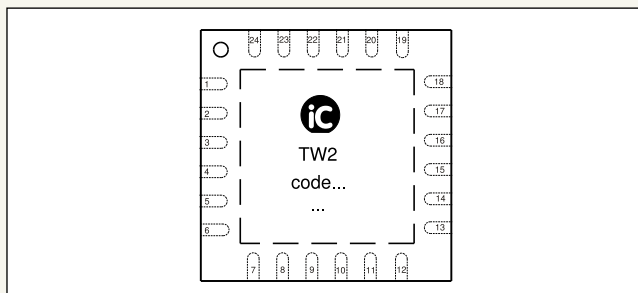
iC-TW2 generates a single index pulse for each input signal period. The index position with respect to the start of the input signal period and also the pulse width thereof can both be programmed.

In addition to the quadrature and 3-phase commutation output modes the chip has two further modes, providing up/down clock signals and, alternatively, increment and direction signals, enabling counters to be interfaced directly.

Pin Functions

No.	Name	Pin Function
1	VDD	+3.3 to +5 V Digital Power Supply
2	B_V	Incremental Output B+ / Commutation Output V
3	NB_V	Incremental Output B- / Signal Output V
4	A_U	Incremental Output A+ / Commutation Output U
5	NA_U	Incremental Output A- / Signal Output U
6	GND	Digital Ground
7	NZ_W	Index Output Z- / Signal Output W
8	Z_W	Index Output Z+ / Commutation Output W
9	1W	Serial 1-Wire Interface, write data input
10	VDDA	+3.3 to +5 V Analog Power Supply
11	GNDA	Analog Ground
12	n.c.	n.c.
13	PB	Pos. Signal Input Channel B (cosine)
14	NB	Neg. Signal Input Channel B (cosine)
15	CLKSEL	Clock Source Selection (low: int., high: ext.)
16	NRST	Reset Input (active low)
17	PA	Pos. Signal Input Channel A (sine)
18	NA	Neg. Signal Input Channel A (sine)
19	VC	Reference Voltage Output (1.21 V)
20	NZ	Neg. Index Enable Input
21	PZ	Pos. Index Enable Input
22	SCLK	Serial 2-Wire Interface, clock input
23	CLKEXT	External Clock Input
24	SDAT	Serial 2-Wire Interface, bidirectional data line

Pin Configuration QFN24 4 mm x 4 mm



Key Specifications

Inputs and Signal Conditioning	
Diff. Input Signal Range	25 mVpp to 1.5 Vpp
Gain Range	1x to 60x (coarse, A and B) 0 dB, 0.6 dB, 1.2 dB, 1.8 dB (fine A, fine B)
Offset Calibration Range	+/- 50 % in steps of 1.6 %
Permissible Input Frequency	up to 460 kHz @ IPF <= 16x up to 230 kHz @ IPF <= 32x up to 115 kHz @ IPF > 32x

Sine-to-Digital Conversion	
Angle Resolutions	1 to 256 steps/period
Interpolation Factors	x0.25 to x64
Absolute Angle Accuracy	+/- 2.8° @ x64 (reduced accuracy modes selectable)
Angle Hysteresis	0°, +/- 1.4°, +/- 2.81°, +/- 5.63°
Input-To-Output Latency (at 30 MHz system clock)	0.53 µs (no filter), 0.8 µs (8 sample average), 1.06 µs (16 sample average)

Incremental Outputs	
Output Operating Modes	A, B and index Z up clock / down clock increment / direction 3-phase commutation
Output Characteristics	TTL/CMOS compatible, +/- 6 mA, tr/td 4 ns @ 3.3 V and CL 10 pF
A/B Output Min. Phase Distance	33 ns to 8.5 µs (programmable core clock rate)
Index Signal Position	adjustable in steps of 1.4°
Index Signal Length	1.4° to 360°, adjustable in steps of 1.4°
Commutation Signal U	start angle adjustable in steps of 1.4°
Commutation Signal V, W	adj. correction of up to +/- 11° vs. U

Controller Interfaces	
1-Wire Interface	write only access to register bank and EEPROM, directly connectable with IR phototransistor as a rugged "in-field" programming port
2-Wire Interface	SPI compatible, read/write access to register bank and EEPROM

Other Operational Data	
Supply Voltage	single 3.3 V to 5 V supply
Operational Temp. Range	-40 to +125 °C
On-Chip System Clock	typ. 30 MHz @ 5V, 25 °C
Package	QFN24 (4 mm x 4 mm)
Device Configuration	via 1-wire serial interface (write only) via 2-wire serial interface (read/write)
On-Chip EEPROM	8x 32 bit, 3x 32 bit reserved section to take OEM data, e.g. serial number and manufacturing information
Calibration Modes	gain and offset, oscillator and index window