iC-LV
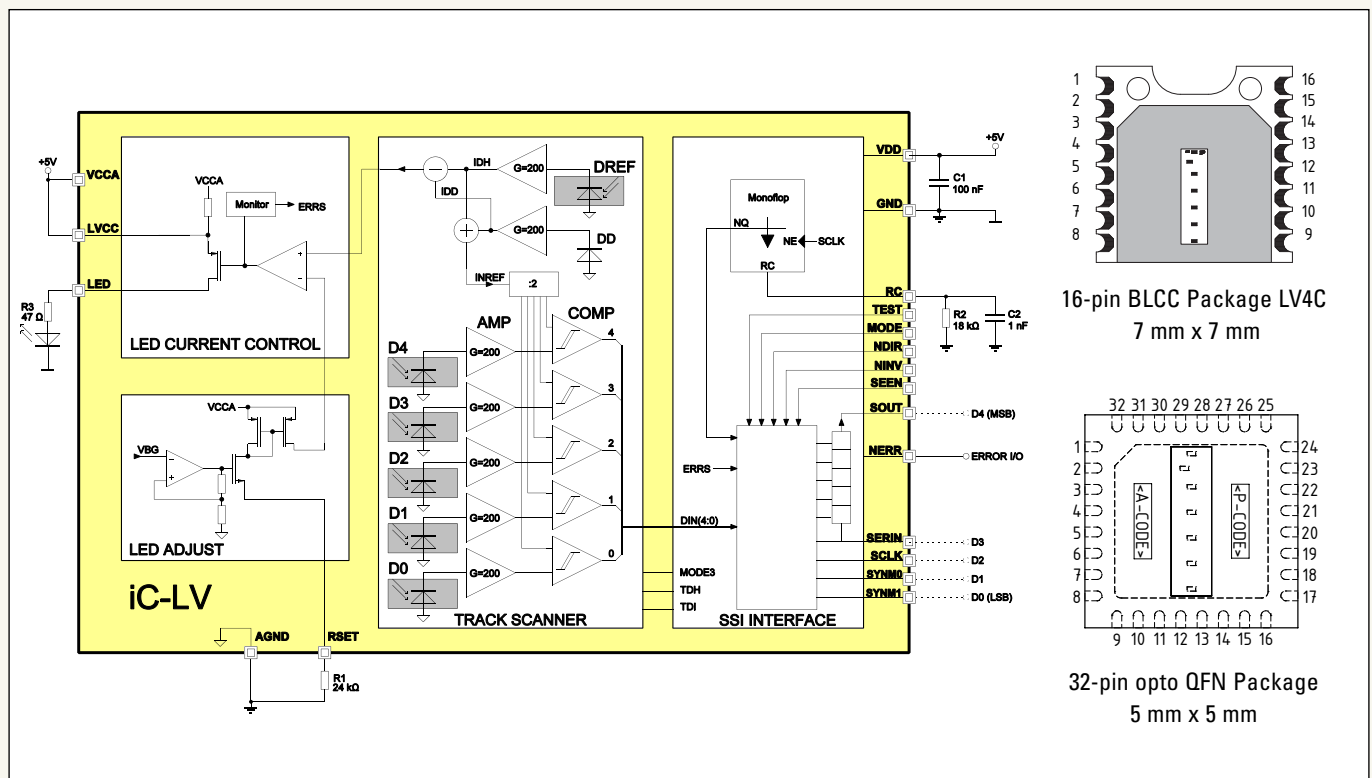## 5-BIT OPTICAL POSITION ENCODER WITH SERIAL/PARALLEL OUTPUT

iC-LV is an optoelectronic encoder IC for absolute position sensing systems such as glass scales and rotary encoders, for example. Photosensors, amplifiers and comparators for 5 tracks at a pitch of 600 µm and a reference photosensor operating the LED power control are monolithically integrated on the chip.

Applications

- Low-resolution singleturn encoders
- Multiturn encoders

Features

- High synchronism and technical reliability due to monolithic construction featuring on-chip photosensors
- Scanning with constant light evaluation at a pitch of 600 µm
- Photocurrent amplifiers with a high cut-off frequency
- Adjustable illumination control with a 40 mA LED driver ensures constant receiver power
- Monitoring of safe operating range with alarm message (e.g. EOL message on LED control error)

- Serial data output via extended SSI interface
- Parallel 5-bit data output in Gray or binary code
- Adjustable MSB track phase selects Gray code direction
- Selectable all-track bit inversion
- Supports chain circuits of multiple devices including synchronization options
- Integrated test aids
- Single 4 to 5.5 V supply, low power consumption

16-pin BLCC Package LV4C
7 mm x 7 mm

32-pin opto QFN Package
5 mm x 5 mm

The internal comparators switch high when the amplified photocurrents exceed a given threshold. This threshold can be adjusted using an external resistor at RSET.

The resistor also establishes a setpoint for the LED current control which irrespective of temperature or the effects of aging keeps the optical receiver power constant. A watchdog generates an alarm message via the error output if the control range is exceeded.

Track information can be read out in parallel (either in Gray or binary code) or serially via an SSI protocol. Here, any number of iC-LVs can be cascaded and synchronized with one another; data is then output as a binary word (requiring Gray code discs). The serial data output can be complemented by an error bit. Electronic test modes can be selected by pin and permit a complete test of functions with the exception of the sensors.

Pin Functions

No.		Name	Interface Mode
BLCC	oQFN	PAR / SER	Pin Function
1	1	LED	LED Power Control Output (high-side current source)
2	2	GND	Ground
3	3	D4 / SOUT	Data Output D4 / Serial Data Output (SSI)
4	4	D3 / SERIN	Data Output D3 / Serial Data Input (SSI)
5	5	D2 / SCLK	Data Output D2 / Clock Input (SSI)
6	6	D1 / SYNM0	Data Output D1 / Sync. Mode Input
7	7	D0 / SYNM1	Data Output D0 / Sync. Mode Input
8	8	SEEN	Serial Error Bit Enable
9	9...17		not connected
10	18	VCCA VDD LVCC	+4...+5.5 V Analog Supply Voltage +4...+5.5 V Digital Supply Voltage +4...+5.5 V LED Driver Supply Voltage
11	19	NINV	Bit-wise Inversion Input
12	20	MODE	Operating Mode Selection Input
13	21	TEST	Test Mode Enable Input (high active)
14	22	RSET	LED Power Control Adjustment (wiring is optional)
15	23	NERR	Error Output (low active)
16	24	NDIR	Direction Input (low active)
	25...		not connected

Key Specifications

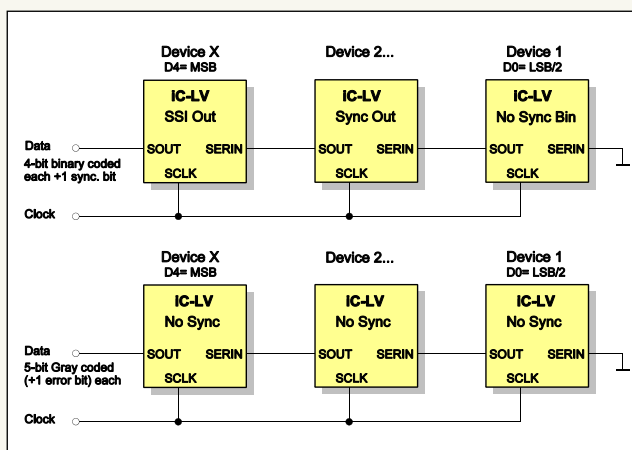| General	
Supply Voltage	single 4 V to 5.5 V
Supply Current	typ. 2 mA
ESD Susceptibilty	2 kV (HBM 100 pF, 1.5 kΩ)
Operational Temperature Range (oQFN)	-40 °C to +110 °C
LED Power Control	40 mA max. (highside current source output)
Chip Size	1.68 mm x 3.5 mm
Package	16-pin BLCC LV4C (7 mm x 7 mm x 1.7 mm) 32-pin oQFN32 5 mm x 5 mm
Package Options	customized COB systems

Position Acquisition	
Max. Singleturn Resolution	5 bits / 360° (32 CPT) or 4+1 bits / 360° (synchronization modes)
Max. Multiturn Resolution	12 bits (3x iC-LV), 24 bits (6x iC-LV)
Max. Operating Speed	12,000 RPM (mode SSI Out, 200 kHz clock rate, 3x iC-LV)

Data I/O	
Serial Two-Wire Interface	up to 2 MHz, SSI compatible
Parallel Data Output	5 bits, to 100 kHz, +/- 4 mA, CMOS levels

Operational Functions	
Device Configuration	by pin
Parameterization	output data formats (parallel, serial, error bit), encoding, MSB bit inversion, code inversion
Monitoring & Alarm	illumination error (end of life)
Test Modes	analog sensor stimulation

Serial Operational Modes	
Name	Shift Data Format
No Sync	5(+1)-bit Gray coded (option: error bit)
No Sync Binary	5-bit binary coded
Sync Out	4-bit binary coded, corrected by +/- 1
SSI Out	4-bit binary coded, corrected by +/- 1

Application Examples