

FEATURES

- ◆ Monolithic construction with integrated photodiodes ensures excellent matching and technical reliability
- ◆ Short track spacing of 600µm
- ◆ Elimination of dark currents through differential scanning
- ◆ Photocurrent amplifier with high cut-off frequency
- ◆ Comparators with precise signal-related hysteresis
- ◆ Current-limited push-pull outputs
- ◆ Adjustable LED current control for constant received power
- ◆ Integrated power driver for the LED
- ◆ LED current monitor with error message output
- ◆ Integrated test aid
- ◆ Low power consumption from 5V supply voltage
- ◆ Available as a 20-pin BLCC, as an SO18-opto package or as a chip; reticle assembly is optional
- ◆ Package BLCC20 can be delivered with an extended temperature range of -30..110°C

APPLICATIONS

- ◆ Optical position decoding using the principle of differential scanning
- ◆ Incremental and absolute encoder with a resolution of up to 8 bits

PACKAGES

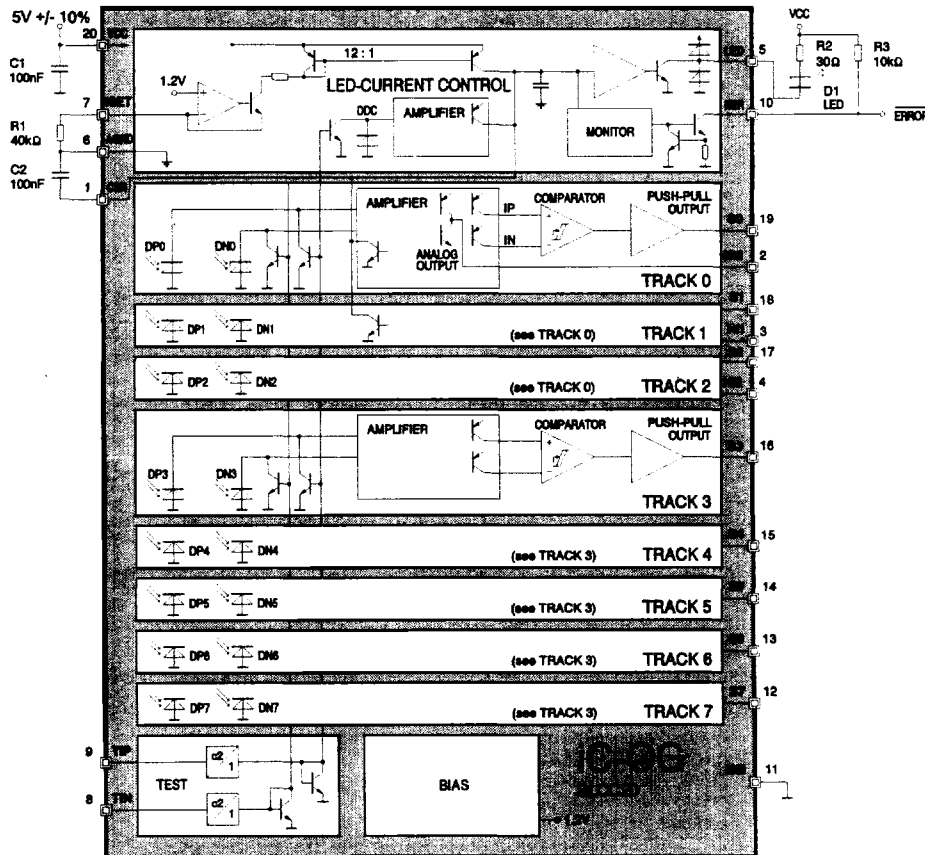


BLCC20 8.2mm x 9.6mm



SO18-opto

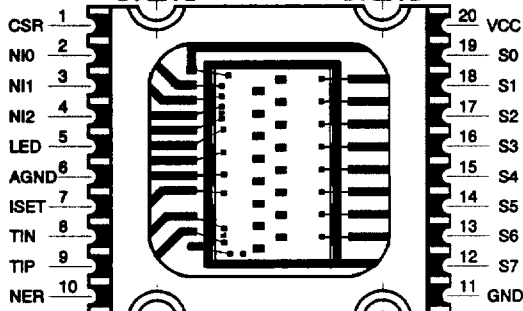
BLOCK DIAGRAM



Jul 04, 1996

PACKAGE BLCC20

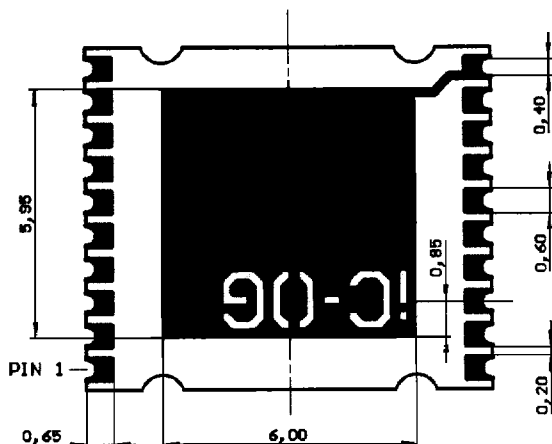
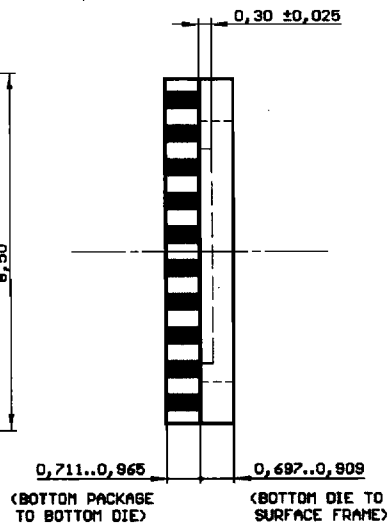
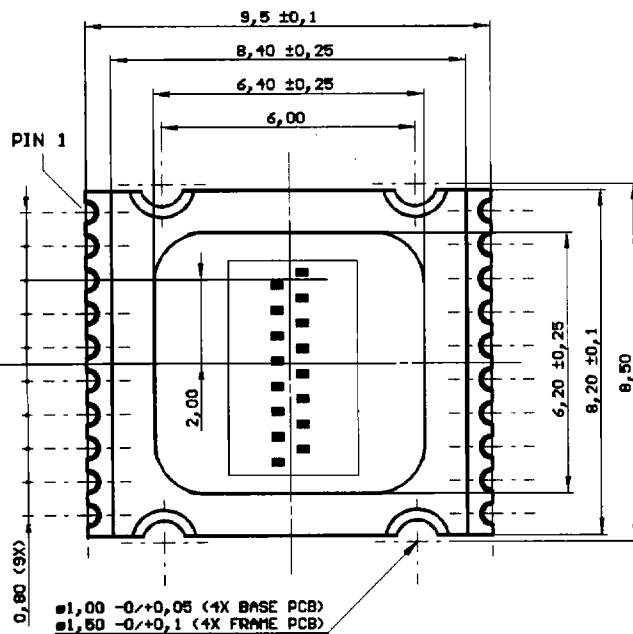
PIN CONFIGURATION (top view)



PIN FUNCTIONS

No.	Name	Function
1	CSR	Ext. capacitor for LED control
2	NI0	Push-Pull Analog Output Track 0
3	NI1	Push-Pull Analog Output Track 1
4	NI2	Push-Pull Analog Output Track 2
5	LED	Output LED Driver
6	AGND	Ground, only for resistor at ISET
7	ISET	Control Preset
8	TIN	- Input Test Aid
9	TIP	+ Input Test Aid
10	NER	Error Message Output
11	GND	Ground
12	S7	Push-Pull Output, Track 7
..
19	S0	Push-Pull Output, Track 0
20	VCC	Power Supply Voltage 5V

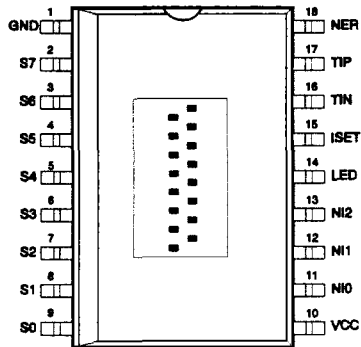
PHYSICAL DIMENSIONS (in mm)



NOTE:
 NEGATIVE OUTLINE TOLERANCES DUE TO SAWING PROCESS
 COPPER-IMAGE TOLERANCES = $\pm 30 \mu\text{m}$ (WIDTH AND SPACING)
 ALL FRAME TOLERANCES: $\pm 0,25$
 CHIP-LOCATION TOLERANCE: $\pm 0,15$

PACKAGE SO18-opto

PIN CONFIGURATION (top view)



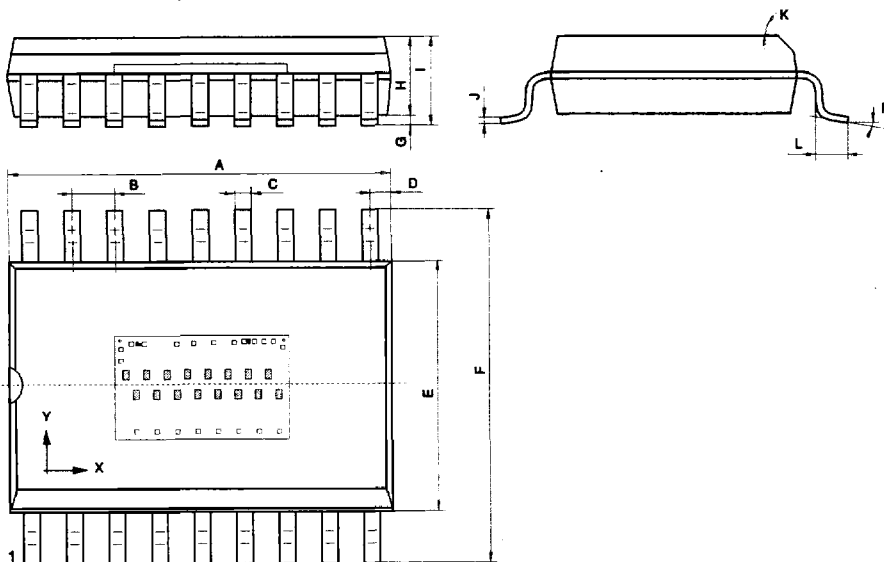
PIN FUNCTIONS

No.	Name	Function
1	GND	Ground
2	S7	Push-Pull Output, Track 7
..
9	S0	Push-Pull Output, Track 0
10	VCC	Power Supply Voltage 5V
11	NI0	Push-Pull Analog Output Track 0
12	NI1	Push-Pull Analog Output Track 1
13	NI2	Push-Pull Analog Output Track 2
14	LED	Output LED Driver
15	ISET	Control Preset
16	TIN	- Input Test Aid
17	TIP	+ Input Test Aid
18	NER	Error Message Output

PHYSICAL DIMENSIONS

Max. deviation of center photodiodes to leadframe:

x: +/- 0.2mm, y: +/- 0.6mm



Dimensions in mm

	Min.	Max.
A	11.48	11.68
B	1.27	
C	0.36	0.46
D	0.71	
E	7.40	7.60
F	10.11	10.51
G	0.10	0.30
H	2.34	
I	2.44	2.64
J	0.23	0.32
K	45 DEG	
L	0.51	1.01
M	5 DEG	

PACKAGE LABEL (bottom view)

iC-OG Code
yyww

ABSOLUTE MAXIMUM RATINGS

(Values beyond which damage may occur; device operation is not guaranteed)

Item	Symbol	Parameter	Conditions	Fig.			Unit
					Min.	Max.	
G1	VCC	Supply Voltage			-0.3	6	V
G301	V(S)	Voltage at Outputs S0..7			-0.3	VCC+0.3	V
G302	I(S)	Current in Outputs S0..7	V(S) < 0V or V(S) > VCC		-3	3	mA
G601	I(TIP) I(TIN)	Current in TIP, TIN			-1	1	mA
G701	I(ISET)	Current in ISET			-1	0.1	mA
G702	I(AGND)	Current in AGND			-5	5	mA
G703	I(LED)	Current in LED	V(LED) < 0 or V(LED) > VCC		-3	3	mA
G704	I(LED)	Current in LED	0 < V(LED) < VCC		0	150	mA
G705	V(CSR)	Voltage at CSR			-0.3	VCC+0.3	V
G706	I(CSR)	Current in CSR			-3	3	mA
G801	V(NI)	Voltage at Analog Outputs NI0..2			-0.3	VCC+0.3	V
G802	I(NI)	Current in Analog Outputs NI0..2			-3	3	mA
GA01	V(NER)	Voltage at NER			-0.3	6	V
TG1	Tj	Chip Temperature			-25	90	°C
TG2	Ts	Storage Temperature			-25	90	°C

THERMAL DATA

Operating Conditions: VCC= 5V ±10%

Item	Symbol	Parameter	Conditions	Fig.				Unit
					Min.	Typ.	Max.	
T1	Ta	Operating Ambient Temperature Range (extended temperature range on request)	Package BLCC20 Package S018-opto		-20 0		90 70	°C °C

All voltages are referenced to ground unless otherwise noted.
 All currents into the device pins are positive; all currents out of the device pins are negative.

Operating Conditions: VCC= 5V ±10%

Min./Max. values noted only once apply over the listed junction temperatures Tj.

Item	Symbol	Parameter	Conditions	Fig.	Tj = -30 °C			Tj = 27 °C			Tj = 85 °C			Tj = 125 °C			Unit
					Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
Photodiodes and Amplifiers, tracks 0..7																	
101	Aph(D)	Radiant Sensitive Area			0.2 × 0.3											mm ²	
102	S(A)max	Spectral Sensitivity	λ= 850nm		0.5											A/W	
103	Se(A)	Range of Spectral Sensitivity	Se(A)= 0.1 × S(A)max		500											nm	
104	I(D)	Permissible Photocurrent			90											nA	
105	CM(C)	Common Mode DPI to DNI			0.85 1 1.15												
Difference Comparators, tracks 0..7																	
201	Hys	Hysteresis referred to [(DPI) + I(DNI)] / 2	I(DPI, DNI)= 3..90mA		8 11 14											%	
Push-Pull Outputs S0..7																	
301	Vs()hi	Saturation Voltage hi	Vs()hi= VCC-V(); I()= -40µA I()= -400µA		0.79 0.9 0.9			0.69 0.83 0.83			0.58 0.74 0.74			0.51 0.68 0.68			V
302	Vs()lo	Saturation Voltage lo	I()= 1.6mA		0.21 0.4 0.4			0.22 0.22 0.22			0.25 0.25 0.25			0.27 0.27 0.27			V
303	Isc()hi	Short-Circuit Current hi	V()= 0V..VCC-1V		-7 -4.6 -1.5												mA
304	Isc()lo	Short-Circuit Current lo	V()= 0.4V..VCC		1.8 7.3 13												mA
305	SRhi	Slew-Rate hi	CL()= 30pF		24 130 130			61 61 61									V/µs
306	SRlo	Slew-Rate lo	CL()= 30pF		50 330 330			115 115 115									V/µs
307	Vc()hi	Clamp Voltage hi	Vc()hi= V()-VCC; S= hi, I()= 3mA		0.4 1.5 1.5												V
308	Vc()lo	Clamp Voltage lo	S= lo, I()= -3mA		-1.5 -0.4 -0.4												V

Operating Conditions: VCC= 5V ±10%

Min./Max. values noted only once apply over the listed junction temperatures Tj.

Item Symbol	Parameter	Conditions	Fig.	Tj = -30 °C			Tj = 27 °C			Tj = 85 °C			Tj = 125 °C			Unit	
				Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
Test Aid TIP, TIN																	
601	CR(TIP), CR(TIN) Current Ratio I(TIP) / I(DPI, DDC) and I(TIN) / I(DNI)	Test aid active, I(TIP, TIN)= 2..200µA		750	1100	1600											
602	I(t) Pull-Down Current at TIP, TIN; Test Aid Turn-on Threshold	V(TIP, TIN)= 0.4V		2.5	14	125		19			25			28		µA	
603	V(TIP), V(TIN) Voltage at TIP, TIN	Test aid active; I(TIP)= 2..200µA and I(TIN)= 100µA, or I(TIP)= 100µA and I(TIN)= 2..200µA		1.9	2.4	2.7		1.6	2.1	2.4	1.3	1.8	2.1	1.1	1.6	1.9	V

DESCRIPTION OF FUNCTIONS

LED current control

The integrated LED current control with a driver stage controls the LED in accordance with the sum of the photocurrents from the tracks 0 and 1. Compensation is made for age and dirt, as well as for the reduced efficiency of the LED caused by rises in temperature.

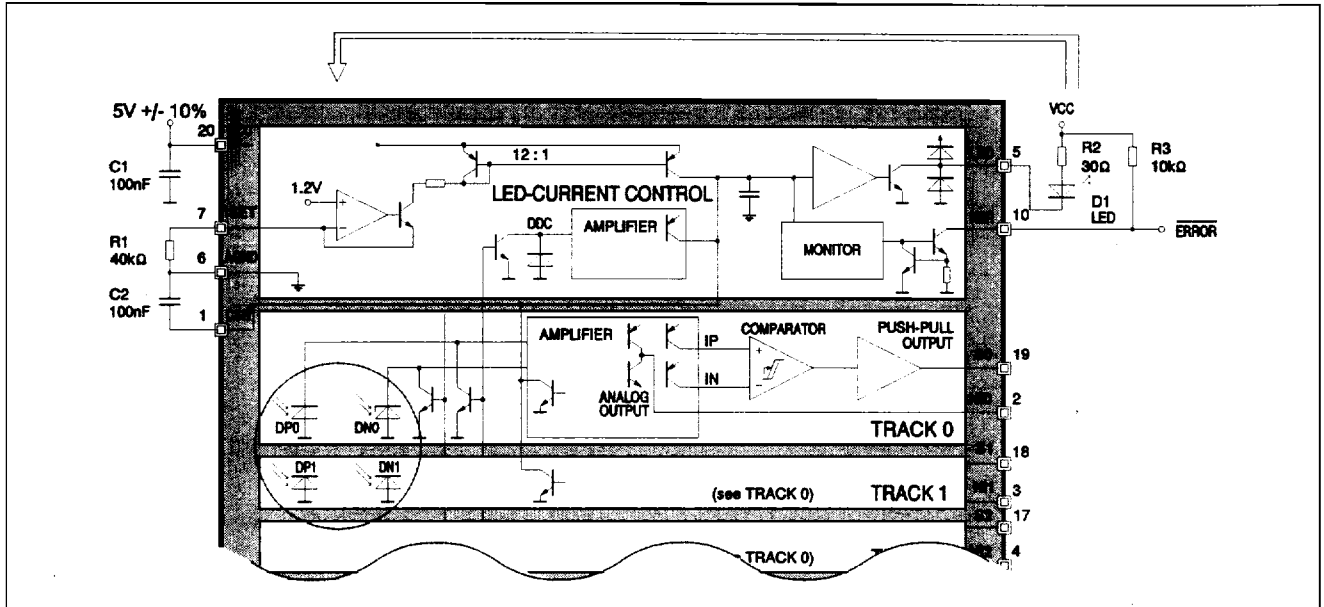


Fig. 1: LED Current Control and Monitoring

The photodiodes DPO, DNO, DP1 and DN1 act as reference diodes. The sum is output via a current sink to the comparison point pin CSR. Simultaneously, the resistor R1 at pin ISET (the voltage at the ISET pin is kept at a constant of approximately 1.22V) supplies a reference current for the current source from VCC, which also works towards the comparison point pin CSR. The comparison point also receives the amplified current from the compensation diode DDC in order to compensate for dark currents and for the amplifier input currents.

If there is an optical feedback from the LED to the reference photodiodes, the voltage at the CSR pin adjusts to satisfy the needs of the power driver for the required transmit current at pin LED. In this instance, the voltage ratio between $I(\text{ISET})$ and the sum of the photodiode current $I(\text{SUM})$ is constant (Electrical Characteristics Nos. 706 and 707). The current flowing through the resistor R1 is the setpoint for the control and directly presets the desired level of illumination.

An internal capacitor ensures that the control is stable. The comparison point pin CSR is lead out in the BLCC20 package, enabling an external capacitor C2 to be connected to adapt the control behaviour. Lower values for R1 require larger values for C2, which also improve the power-supply rejection ratio for the control. Values from 10nF upwards are recommended.

A resistor in series with the LED limits the current in pin LED and sets the operating limits of the control.

The optical feedback between the LED and the reference photodiodes should be good enough to establish an LED current of less than 15mA at room temperature. Only under these conditions does the power driver have a sufficient current reserve to correct the LED's decline in efficiency even at high temperatures.

Control Monitor and Error Message Output

The control monitor observes the potential at the CSR pin. Voltages which bring the power driver to saturation or off-state are recognized and indicated at the open-collector output by $\text{NER} = \text{low}$.

APPLICATIONS INFORMATION**Using the test aid**

The threshold current defined in the electrical characteristic No. 602 must be exceeded at both pins TIP and TIN simultaneously to activate the iC-OG's built-in test aid. Once it has been activated, the test aid does not switch back to off-state until the current drops below approx. $1\mu\text{A}$.

A clamp circuit as shown in Figure 2 also prevents falling below the test aid turn-on threshold for a short time. The output polarity of the iC-OG is to be changed over with the switch.

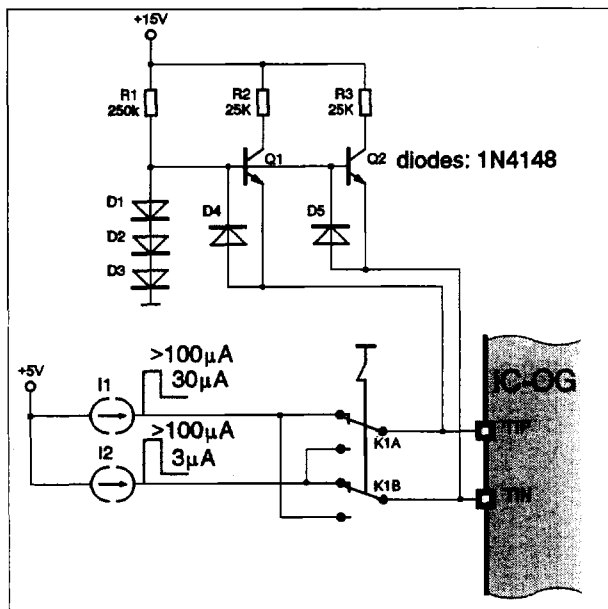


Fig. 2: Wiring the test aid

ORDERING INFORMATION

Type	Package	Order designation
iC-OG	-	iC-OG <i>Chip</i>
iC-OG	BLCC20	iC-OG-BLCC20
iC-OG	SO18-opto	iC-OG-SO18-opto

For information about prices, terms of delivery, options for other case types, etc., please contact:

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