

iC-LSB

8-CHANNEL ACTIVE PHOTODIODE ARRAY



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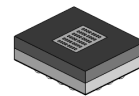
FEATURES

- Monolithic array of independent photodiodes with excellent matching
- Compact photodiode size of $800\ \mu\text{m} \times 300\ \mu\text{m}$ enabling high-quality encoder scanning at reduced system dimensions
- Narrow track pitch of $0.42\ \text{mm}$ cuts down illumination efforts
- Enhanced EMI immunity due to on-chip pre-amplification
- Dark current compensation permits high temperature operation
- Open-collector outputs as highside current source
- Simple gain setting and current-to-voltage conversion by external load resistors
- Single supply operation from $4\ \text{V}$ to $5.5\ \text{V}$
- Low power consumption
- Space saving, RoHS compliant optoQFN and optoBGA packages
- Options: extended temperature range of -40 to $125\ ^\circ\text{C}$, customized COB modules, reticles and code discs

APPLICATIONS

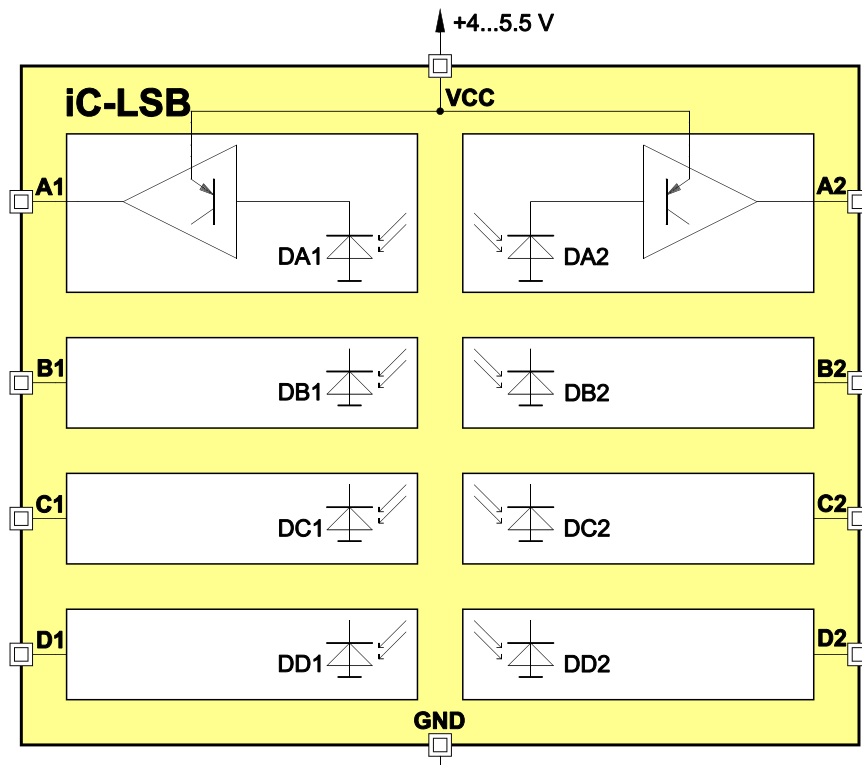
- Optical position encoding from analog sine/cosine signals
- Incremental encoders with index signal

PACKAGES



14-pin optoBGA
6.2mm x 5.2mm

BLOCK DIAGRAM



iC-LSB

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DESCRIPTION

The iC-LSB sensor array, coming with 8 independent channels, is a general purpose optoelectronic scanner made to suit a variety of encoding applications, such as rotary and linear encoders used for motion control, robotics, power tools etc.

The sensor array features monolithically integrated photodiodes with active areas of $800\ \mu\text{m} \times 300\ \mu\text{m}$ each in combination with fast on-chip photocurrent amplifiers, enabling an analog output at reasonable signal strength to the circuit board.

The highside current source output construction

avoids a ground referenced signal and permits the subsequent electronics to adjust the gain. In its simplest form this is done by load resistors, for instance.

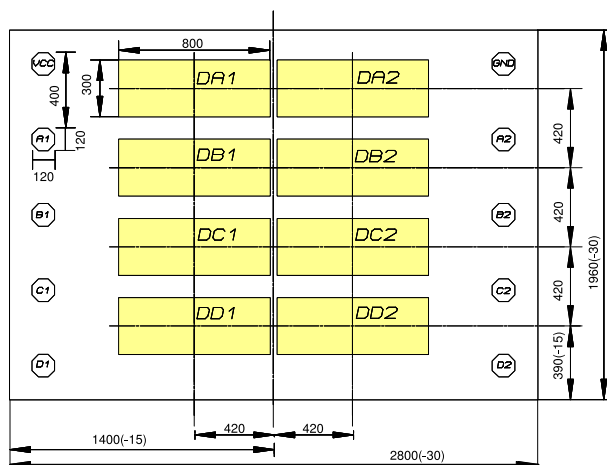
The spectral sensitivity range includes visible to near infrared light, with the maximum sensitivity being close to a wavelength of 700 nm.

Output currents of up to $50\ \mu\text{A}$ are supplied under low light conditions, for instance when illuminated at only $3\ \mu\text{W}/\text{mm}^2$ by an 850 nm LED. The photocurrent gain is 46 dB typically.

PACKAGES

PAD LAYOUT

Chip size 2.80 mm x 1.96 mm



PAD FUNCTIONS

No. Name Function

- | | | |
|----|-----|--------------------------------|
| 1 | VCC | +4...5.5 V Supply Voltage |
| 2 | A1 | Highside Current Source Output |
| 3 | B1 | Highside Current Source Output |
| 4 | C1 | Highside Current Source Output |
| 5 | D1 | Highside Current Source Output |
| 6 | D2 | Highside Current Source Output |
| 7 | C2 | Highside Current Source Output |
| 8 | B2 | Highside Current Source Output |
| 9 | A2 | Highside Current Source Output |
| 10 | GND | Ground |

iC-LSB

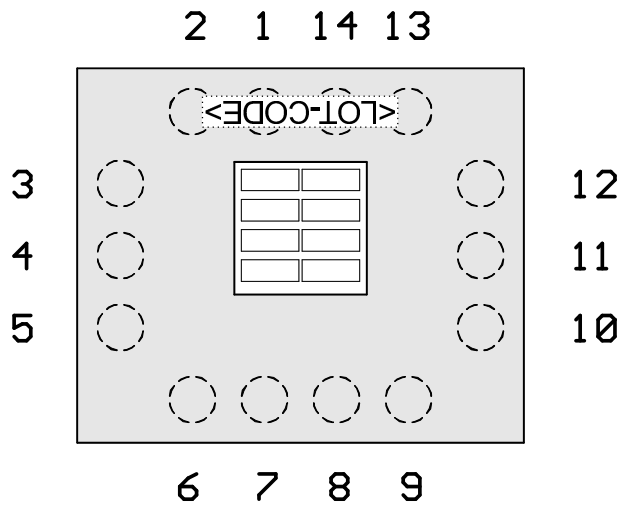
8-CHANNEL ACTIVE PHOTSENSOR ARRAY



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PIN CONFIGURATION

oBGA LS2C (6.2 mm x 5.2 mm)



PIN FUNCTIONS

No. Name Function

| | | |
|-------|------|--------------------------------|
| 1 | VCC | +4...5.5 V Supply Voltage |
| 2 | A1 | Highside Current Source Output |
| 3 | B1 | Highside Current Source Output |
| 4 | C1 | Highside Current Source Output |
| 5 | D1 | Highside Current Source Output |
| 6...9 | n.c. | |
| 10 | D2 | Highside Current Source Output |
| 11 | C2 | Highside Current Source Output |
| 12 | B2 | Highside Current Source Output |
| 13 | A2 | Highside Current Source Output |
| 14 | GND | Ground |

Pin numbers marked n.c. are not in use. For dimensional specifications refer to the relevant package data sheets, available separately. IC top markings, such as <LOT CODE>, indicate the orientation of the device.

ABSOLUTE MAXIMUM RATINGS

These ratings do not imply operating conditions; functional operation is not guaranteed. Beyond these ratings device damage may occur.

| Item No. | Symbol | Parameter | Conditions | Limits | | Unit |
|----------|--------|---------------------------------|---------------------------------------|--------|---------|------|
| | | | | Min. | Max. | |
| G001 | VCC | Voltage at VCC | | -0.3 | 6 | V |
| G002 | I(VCC) | Current in VCC | | -20 | 20 | mA |
| G003 | V() | Pin Voltage, all signal outputs | | -0.3 | VCC+0.3 | V |
| G004 | I() | Pin Current, all signal outputs | | -20 | 20 | mA |
| G005 | Vd() | ESD Susceptibility, all pins | HBM, 100 pF discharged through 1.5 kΩ | | 2 | kV |
| G006 | Tj | Junction Temperature | | -40 | 150 | °C |
| G007 | Ts | Chip Storage Temperature | | -40 | 150 | °C |

THERMAL DATA

| Item No. | Symbol | Parameter | Conditions | Limits | | | Unit |
|----------|--------|-------------------------------------|---|--------|------|------------|----------|
| | | | | Min. | Typ. | Max. | |
| T01 | Ta | Operating Ambient Temperature Range | package oBGA LS2C (extended temperature range on request) | -20 | | 90 | °C |
| T02 | Ts | Storage Temperature Range | package oBGA LS2C | -30 | | 110 | °C |
| T03 | Tpk | Soldering Peak Temperature | package oBGA LS2C tpk < 20 s, convection reflow tpk < 20 s, vapor phase soldering TOL (time on label) 8 h; Please refer to customer information file No. 7 for details. | | | 245 230 | °C °C |

All voltages are referenced to ground unless otherwise stated.

All currents flowing into the device pins are positive; all currents flowing out of the device pins are negative.

ELECTRICAL CHARACTERISTICS

Operating conditions: $V_{CC} = 4...5.5\text{ V}$, $T_j = -40...125\text{ }^\circ\text{C}$, unless otherwise stated

| Item No. | Symbol | Parameter | Conditions | | | | Unit |
|--------------------------------|---------------------|---|---|-------------|------------|-----------|--------------------------------|
| | | | | Min. | Typ. | Max. | |
| Total Device | | | | | | | |
| 001 | VCC | Permissible Supply Voltage | | 4 | | 5.5 | V |
| 002 | I(VCC) | Supply Current in VCC, dark | $E() = 0$ $T_j = 27\text{ }^\circ\text{C}$ | | 1.0 | 2 | mA mA |
| 003 | I(VCC) | Supply Current in VCC | $\lambda_{LED} = \lambda_{pk}$, $E() = 0.1\text{ mW/cm}^2$ $T_j = 27\text{ }^\circ\text{C}$ | | 1.5 | 4 | mA mA |
| 004 | Vc(hi) | Clamp-Voltage hi at all pins | $I() = 4\text{ mA}$ | | | 11 | V |
| 005 | Vc(lo) | Clamp-Voltage lo at all pins | $I() = -4\text{ mA}$ | -1.2 | | -0.3 | V |
| Photosensors | | | | | | | |
| 101 | E(mx) | Permissible Irradiance | $\lambda_{LED} = \lambda_{pk}$ | | | 0.2 | mW/ cm ² |
| 102 | Aph() | Radiant Sensitive Area | 0.8 mm x 0.3 mm per sensor | | 0.24 | | mm ² |
| 103 | λ_{ar} | Spectral Application Range | $Se(\lambda_{ar}) = 0.25 \times S(\lambda)_{max}$ see Figure 1 | 400 | | 950 | nm |
| 104 | λ_{pk} | Peak Sensitivity Wavelength | see Figure 1 | | 680 | | nm |
| 105 | S(λ) | Spectral Sensitivity | $\lambda_{LED} = \lambda_{pk}$ | | 0.45 | | A/W |
| Photocurrent Amplifiers | | | | | | | |
| 201 | Iph() | Permissible Photocurrent Operating Range | per sensor | 0 | | 200 | nA |
| 202 | $\eta()$ | Photo Sensitivity (light-to-voltage conversion ratio) | $\lambda_{LED} = 740\text{ nm}$ | 60 | | 120 | A/W |
| 203 | CR() | Photocurrent Gain | $CR() = I_{out}() / I_{ph}()$ | 150 | 200 | 250 | |
| 204 | fc(hi) | Cut-off Frequency (-3 dB) | | 150 | 200 | | kHz |
| 205 | $\Delta I_{out}(m)$ | Channel Matching | deviation from mean value | -15 | | +15 | % |
| 206 | $\Delta I_{out}(m)$ | Channel Cross Talk | only one photosensor illuminated at the same time | | 0 | | % |
| Current Source Outputs | | | | | | | |
| 301 | Vout() | Permissible Output Voltage (Operating Range) | | 1 | | VCC - 1.5 | V |
| 302 | Iout() | Permissible Output Current | $V_{out}() = 1\text{ V} \dots V_{CC} - 1.5\text{ V}$ $V_{CC} = 4.5...5.5\text{ V}$, $V_{out}() = 1\text{ V} \dots V_{CC} - 2\text{ V}$ | -50 -200 | | | μA μA |
| 303 | tr(), tf() | Output Current Rise/Fall Time | $I_{ph}: 0 \rightarrow 100\text{ nA}$, 1T settling (63%); $V_{out}() = \text{constant}$ $C_L = 30\text{ pF}$, $R_L() = 10\text{ k}\Omega$ | | 0.7 0.8 | | μs μs |
| 304 | Iout(0) | Output Dark Current | | -0.6 | | +0.6 | μA |

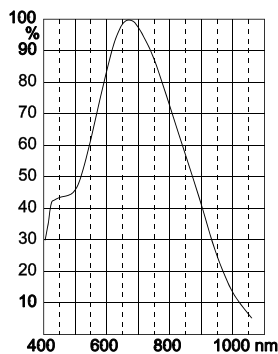


Figure 1: Relative spectral response

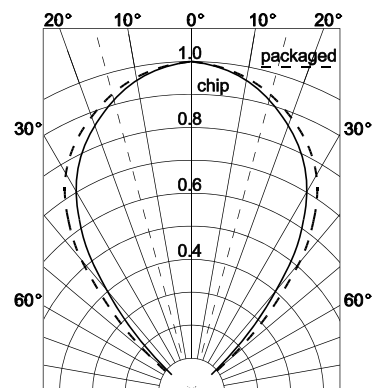


Figure 2: Typical directional characteristics

APPLICATION CIRCUITS

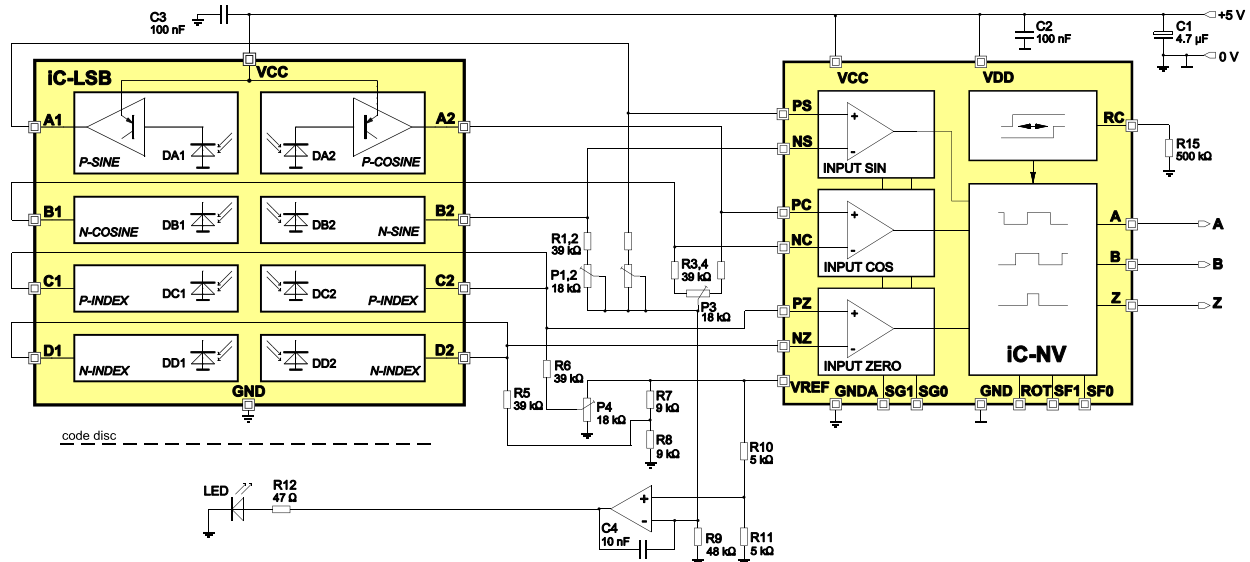


Figure 3: Optical encoder application example. Here, the sine-to-digital converter iC-NV is employed to output spike-free encoder quadrature signals featuring a minimum transition distance.

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ORDERING INFORMATION

| Type | Package | Options | Order Designation |
|--------|-----------------------------------|-----------------|------------------------|
| iC-LSB | - | | iC-LSB chip |
| | 14-pin optoBGA 6.2 mm x 5.2 mm | glass lid | iC-LSB oBGA LS2C |
| | 14-pin optoBGA 6.2 mm x 5.2 mm | on-chip reticle | iC-LSB oBGA LS2C-LSBxR |

For technical support, information about prices and terms of delivery please contact:

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