iC-DX
UNIVERSAL DIGITAL SENSOR OUTPUT DRIVER

preliminary

iC-Haus

FEATURES

- Configurable high-side, low-side and push-pull operation
- Current limited output (< 450 mA)
- Reverse polarity protection
- 150 mA output current
- 5 μs input filter for spike supression
- Wide supply voltage range from 8 to 30 V
- Driver shut-down with over temperature
- Integrated free-wheeling diode for inductive loads
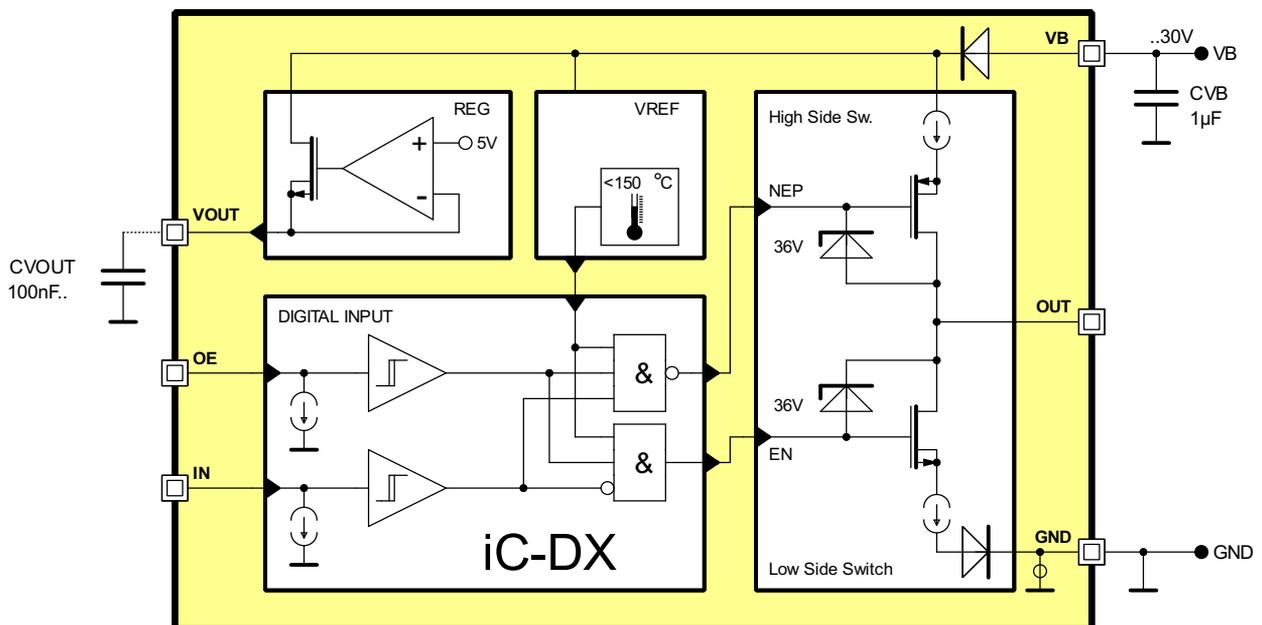- Sensor supply voltage output of 5 V, 10 mA

APPLICATIONS

- Digital sensors
- Light barriers
- Proximity switches

PACKAGES

DFN6 2x2mm

BLOCK DIAGRAM

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DESCRIPTION

The iC-DX is a monolithic switch capable of driving ohmic, inductive and capacitive loads and features integrated reverse polarity protection. The supply voltage VB of the device can range from 8 to 30 V.

Output source/sink-current is at least 150 mA, with saturation voltages of typically 2 V.

With input OE on high level state, the output works as a push-pull stage under control of pin IN. If pin IN is set either to high or low level, the output acts as a high-side (PNP) or low-side (NPN) driver which is activated by a high logic level on input OE.

Output transitions are slew-rate limited to minimize interference on lines. The output is current limited to 450 mA maximum and short circuit protected by shutting down the device with excessive temperature.

A regulated 5 V supply which can be loaded up to 10 mA is available at pin VOUT.

PACKAGES DFN6 2x2

PIN CONFIGURATION
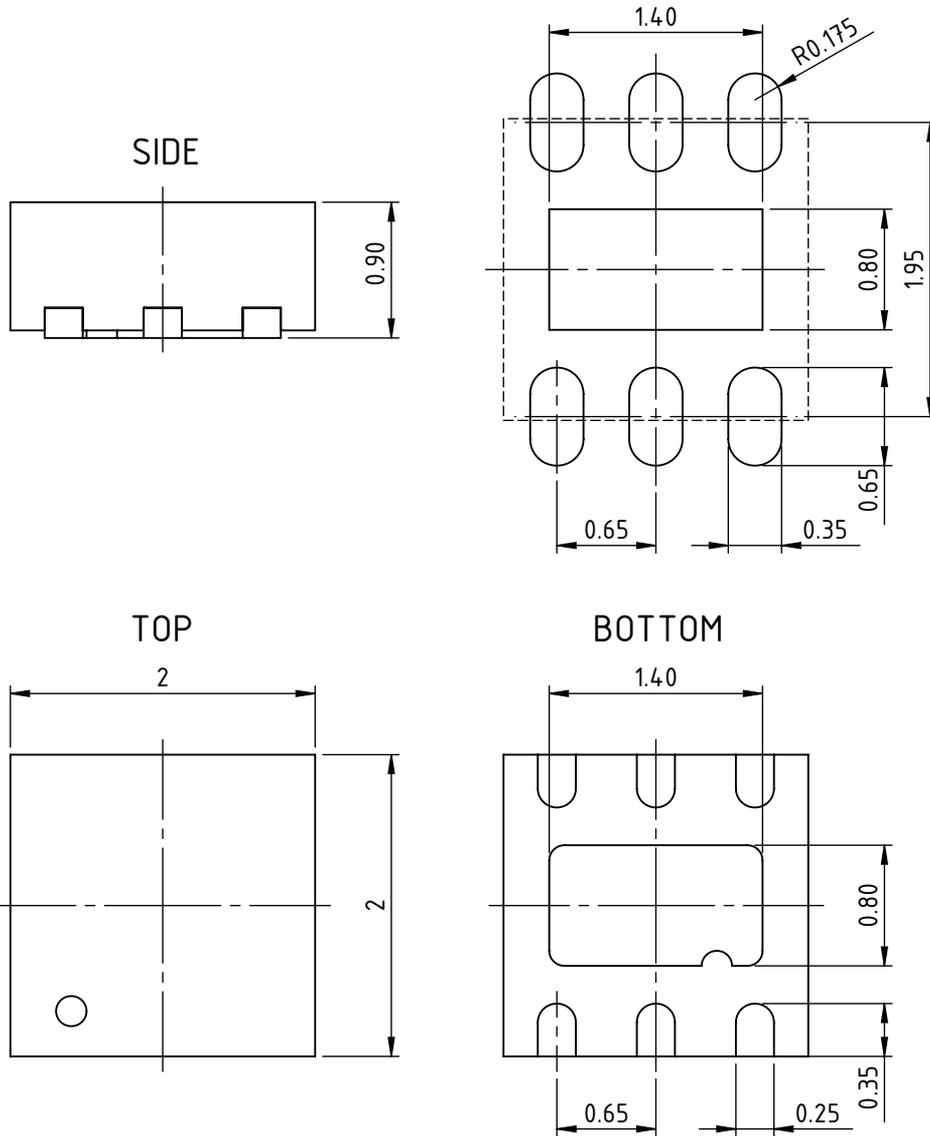

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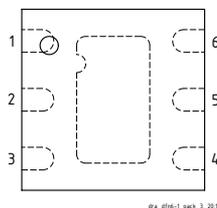
PIN FUNCTIONS

No.	Name	Function
1	VOUT	Regulated +5 V Voltage
2	GND	Ground
3	IN	Input
4	OE	Output Enabled
5	OUT	Driver Output
6	VB	Supply Voltage

The *Thermal Pad* is to be connected to a Ground Plane (GND) on the PCB.
Only pin 1 marking on top or bottom defines the package orientation (top label and coding is subject to change).

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PACKAGE DIMENSIONS DFN6 2x2

SIDE

RECOMMENDED
PCB-FOOTPRINT

1.40

R0.175

0.90

0.80

1.95

0.65

0.65

0.35

TOP

2

2

BOTTOM

1.40

0.80

0.35

0.65

0.25

dra_dfn6-1_pack_5, 20:1

All dimensions given in mm.

ABSOLUTE MAXIMUM RATINGS

Beyond these values damage may occur; device operation is not guaranteed.

Item No.	Symbol	Parameter	Conditions	Min.	Max.	Unit
G001	VB	Supply Voltage		-36	36	V
G002	V()	Voltage at IN, OE		-0.3	7	V
G003	Tj	Junction Temperature		-40	150	°C
G004	Ts	Storage Temperature		-40	150	°C
G005	Vd()	ESD Susceptibility	HBM, 100 pF discharged through 1.5 kΩ	2		kV

THERMAL DATA

Operating Conditions: VB = 8..30 V

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
T01	Ta	Operating Ambient Temperature Range	no thermal shutdown	-40		+150	°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.

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ELECTRICAL CHARACTERISTICS

Operating Conditions: VB = 8..30 V, Tj = -40..150°C, unless otherwise stated

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
General							
001	Vc()lo	Clamp Voltage lo at IN, OE, VOUT	I() = 1 mA			1V	
002	VB	Permissible Supply Voltage	Referenced to GND	8	24	30	V
003	I(VB)	Supply Current in VB	no load, IN = lo, OE = lo IN = lo, OE = hi IN = hi, OE = hi			0.9 1.2 1.5	mA mA mA
004	V(VB)on	Turn-on threshold	increasing VB	6		8	V
005	Ilk(GND)rp	Reverse Polarity Leakage Current	V(VB) = 0; V(OUT) = 0; V(GND)= 0...30 V			300	uA
006	Ilk(OUT)rp	Reverse Polarity Leakage Current	V(VB)=0;V(GND)=0; V(OUT)= 0...30 V			300	uA
007	Ilk(VB)rp	Reverse Polarity Leakage Current	V(OUT) =0 ; GND open; ; V(VB)= 0...30 V			300	uA
Output characteristics							
101	Vs(IOUT)lo	Saturation voltage Low-Side driver	IN = lo, OE = hi I(OUT) = 100 mA I(OUT) = 150 mA			1.5 2	V V
102	Vs(IOUT)hi	Saturation voltage High-Side driver	IN = hi, OE = hi I(OUT) = -100 mA I(OUT) = -150 mA	-1.5 -2			V V
103	Isc()lo	Short-Circuit Current lo in OUT	V(OUT) = 3 V...VB	150		450	mA
104	Isc()hi	Short-Circuit Current Hi in OUT	V() = 0...VB − 3 V	-450		-150	mA
105	Ilk()	Leakage Current at OUT	OUTPUT Disabled V(OUT) = -6...0 V V(OUT) = 0 V...VB V(OUT) > VB...30 V	-100 -40 0		0 40 100	µA µA µA
106	SR()	Slew Rate (switch off → on, switch on → off)	VB = 30 V, Cl = 2.2 nF, I(OUT) = 0			40	V/µs
107	Vfw(OUT)lo	Freewheeling Voltage	I(OUT) = -1 mA, with reference to VB	-47		-36	V
108	Vfw(OUT)hi	Freewheeling Voltage	I(OUT) = 1 mA, with reference to GND	36		47	V
Temperature monitor							
201	Toff	Overtemperature shutdown	increasing Tj	150		185	°C
Inputs OE, IN							
301	Vt()hi	Input Threshold Voltage hi at IN, OE				2	V
302	Vt()lo	Input Threshold Voltage lo at IN, OE		0.8			V
303	Vt()hys	Hysteresis at IN, OE	Vt()hys = Vt()hi − Vt()lo	200			mV
304	Ipd()	Pull-Down Current at IN, OE	V() > 0.4 V	2		150	µA
305	tpio	Propagation Delay IN, OE → OUT		2.1		6.5	µs
306	tsup()	Permissible Spurious Pulse Width at IN, OE				1.6	µs
307	ttrig()	Required Pulse Width at IN, OE		4			µs
Series regulator output VOUT							
401	V(VOUT)	Regulated output voltage	VB = 9..30 V, I(VOUT) = 10 .. 0 mA VB = 8..9 V, I(VOUT) = 10 .. 0 mA	4.7 4.5		5.3 5.3	V V
402	C(VOUT)	Capacitor at VOUT	I(VOUT) = 0 I(VOUT) > 0	0 0.1		10 10	µF µF
403	Isc(VOUT)	Short circuit current at VOUT	VOUT connected to GND			-125	mA

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DESCRIPTION OF FUNCTIONS

iC-DX is a current limited switching channel which enables digital sensors to drive peripheral elements. They are designed to cope with high driver currents. The switches are reverse-polarity protected, feature a free-wheeling circuit for inductive loads, and a current limited output.

Reverse polarity protection
The pins VB, OUT an GND on the *line side* of the chip are reverse polarity protected. As far as the maximum voltage ratings are not exceeded, no possible supply combination at the *line side* pins can damage the chip.
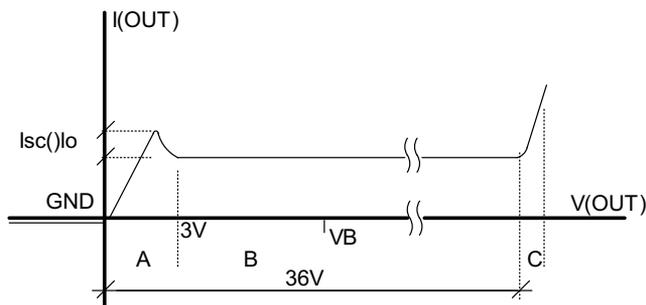
Figure 1: OUT characteristic when Low side active
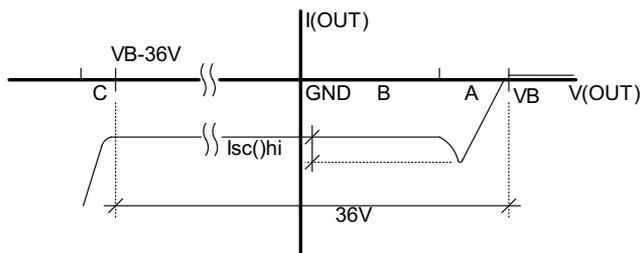
Figure 2: OUT characteristic when high side active

Output characteristics of OUT
The switching channel is current limited to a value between 150mA and 450mA. (cf. Electrical Characteristics Nos. 103, 104). The current limitation works only for voltages higher than 3 V at OUT resp. lower than VBO − 3 V. For smaller output voltages the current limitation is reduced in order to minimise the saturation voltages without increasing the power dissipation. Figures 1 and 2 show the characteristic of the switching channels when activated. Region "A" is the saturation range, where the current limitation is not fully active yet and region "B" is the current limited range. Region "C" corresponds to the free-wheeling circuit activated. The switching channel is designed so that the low side can only sink current and high side can only source current (no reverse current).

Free-wheeling circuit for inductive loads
The free-wheeling circuit is always present and does not depend on the current output status. It is activated by voltages higher than 36 V at OUT referenced to GND or lower than -36 V at OUT referenced to VB. In that case the correspondent channel will switch on without current limitation (see Figure 3).
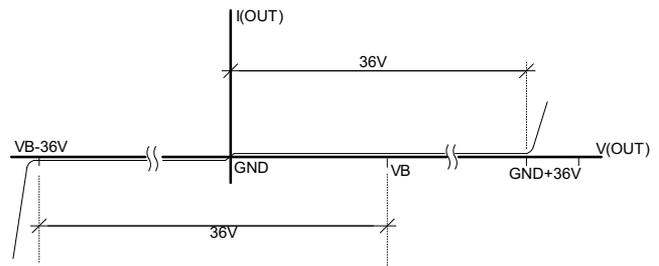
Figure 3: Free-wheeling characteristic

OPERATION MODES

The iC-DX can be operated in high-side, low-side and push-pull switch mode. Figure 4 shows the high-side operation where IN pin must be kept high and the OE pin controls the switch. Figure 5 shows the low-side operation where IN pin must be kept low and the OE pin controls the switch. Figure 6 shows the push-pull operation where OE pin must be kept high and the IN pin controls the switch.
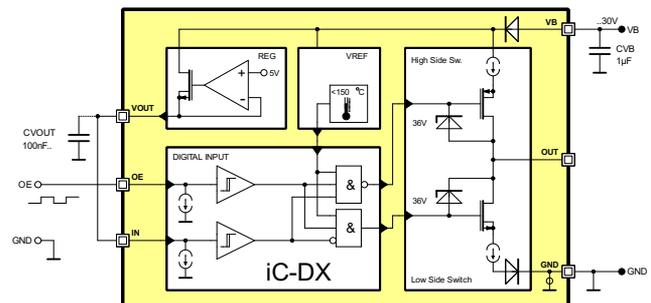

Figure 4: Configuration as high side

iC-DX
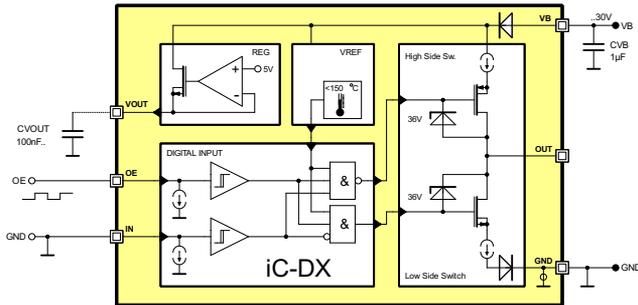## UNIVERSAL DIGITAL SENSOR OUTPUT DRIVER

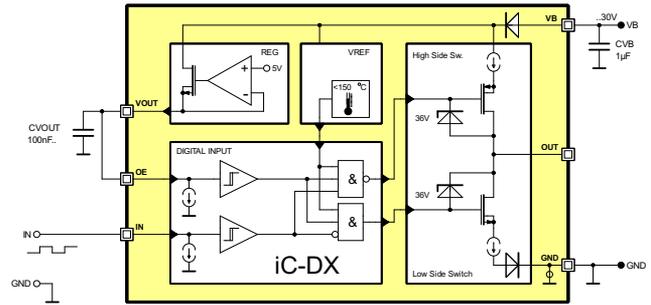*preliminary*

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Figure 5: Configuration as low side

Figure 6: Configuration as Pushpull

TIMING DESCRIPTION

The iC-DX has a built-in spurious pulse suppression that prevents short (undesired) pulses at the input pins from reaching the output. Every pulse at OE or IN pins shorter than 1.6 µs (cf. Electrical Characteristics No. 306) will be ignored and the output will not react. The minimum required pulse length to be sure that the output reacts is 4 µs (cf. Electrical Characteristics No. 307). That means that every pulse longer than 4 µs will be propagated to the output but with an additional propagation delay of 1.2 µs maximum. The resulting maximum propagation delay is 5.2 µs (cf. Electrical Characteristics No. 305).

Figure 8: Block diagram with EN and NEP internal signals
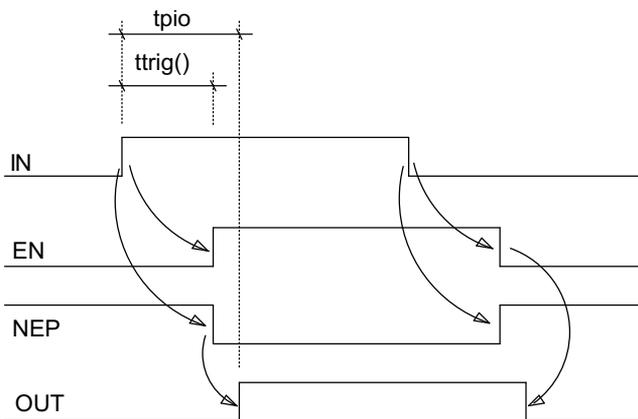
Figure 7: Timing diagram in push-pull operation mode

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ORDERING INFORMATION

Type	Package	Order Designation
iC-DX	DFN6	iC-DX DFN6

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

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GERMANY   **E-Mail: sales@ichaus.com**

Appointed local distributors: http://www.ichaus.com/sales_partners