

Intelligent Half-Bridge Drivers

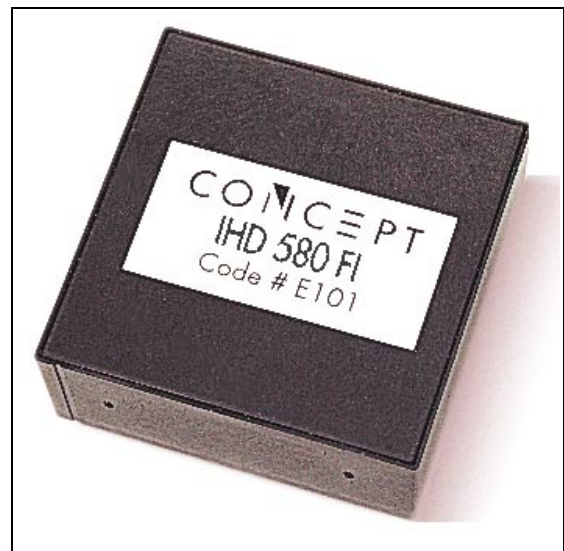
for IGBTs and Power MOSFETs

Description

The intelligent half-bridge drivers of the IHD type series have been developed specifically for the reliable driving and secure protection of IGBT or power MOSFET pairs.

The drivers of the IHD580Fx series are a further development of the IHD215/280/680 series. The IHD580Fx types are designed for higher operating and isolation voltages than the standard types, but are otherwise fully pin-compatible.

There is no logic link or mutual blocking between the control inputs of the two channels. The drive components are thus of highly universal design and can be used for half-bridge, asymmetrical half-bridge and mid-point circuits as well as for all other PWM converters and resonance topologies.



Product Highlights

- ✓ Suitable for IGBTs and power MOSFETs
- ✓ Protect the power transistors
- ✓ Reliable and long service life
- ✓ High gate current of $\pm 8A$
- ✓ Electrical isolation 5000 Vac
- ✓ Electrically isolated status acknowledgement
- ✓ Monitoring of power supply and self-monitoring
- ✓ Switching frequency DC to MHz
- ✓ Duty cycle: 0... 100%
- ✓ Signal transmission is realised by fiber-optic links
- ✓ Shorten development time

Applications

- ✓ Inverters
- ✓ Motor drive technology
- ✓ Traction
- ✓ Railroad power supplies
- ✓ Converters
- ✓ Power engineering
- ✓ Switch-mode power supplies
- ✓ Radiology and laser technology
- ✓ DC/DC converter
- ✓ Research
- ✓ RF generators and converters

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Important Note

The IHD580FI/FN drivers are a further development of the tried-and-tested IHD680AI/AN half-bridge drivers. In contrast to the standard drivers, however, the IHD580Fx types are designed for higher operating and isolation voltages. The IHD580Fx types are particularly suitable for 1600/1700V-IGBTs.

This data sheet lists only those specifications that differ for the IHD580Fx drivers compared with the IHD680AI/AN types. Data sheet IHD215/280/680, type IHD680Ax, applies for all other technical specifications and application hints.

The IHD580Fx drivers are supplied in the same design (package) as those of the IHD series and are largely pin-compatible with them. The integrated DC/DC converter with a power of 6 W is of the same type as in the IHD680Ax. Because of the higher self-consumption of the IHD580Fx, however, the usable output power is limited to 5 W.

All specifications in this data sheet refer to types from manufacturing code #FxxxB onwards.

Pin Designation

Pin	Desig.	Function	Pin	Desig.	Function
1	SO1+	Status output + (CH.1)	36	G1	Gate driver output (CH.1)
2	SO1-	Status output - (CH.1)	35	COM1	Virtual common (CH.1)
3	IN1-	Input GND (CH.1)	34	Cs1	Blocking capacitor (CH.1)
4	IN1+	Input signal (CH.1)	33	E1	Emitter / Source (CH.1)
5		free	32	REF1	External reference (CH.1)
6		free	31	Cb1	Blocking time capacitor (CH.1)
7		free	30	ME1	Vce measurement (CH.1)
8		free	29		free
9	GND	Power supply GND	28		free
10	Vcc	Power supply plus terminal	27		free
11		free	26		free
12		free	25	G2	Gate driver output (CH.2)
13		free	24	COM2	Virtual common (CH.2)
14		free	23	Cs2	Blocking capacitor (CH.2)
15	SO2+	Status output + (CH.2)	22	E2	Emitter / Source (CH.2)
16	SO2-	Status output - (CH.2)	21	REF2	External reference (CH.2)
17	IN2-	Input GND (CH.2)	20	Cb2	Blocking time capacitor (CH.2)
18	IN2+	Input signal (CH.2)	19	ME2	Vce measurement (CH.2)

Legend:

(CH.1) = Channel 1; (CH.2) = Channel 2

Pins with the designation "free" are not physically present

Block and Connection Diagram

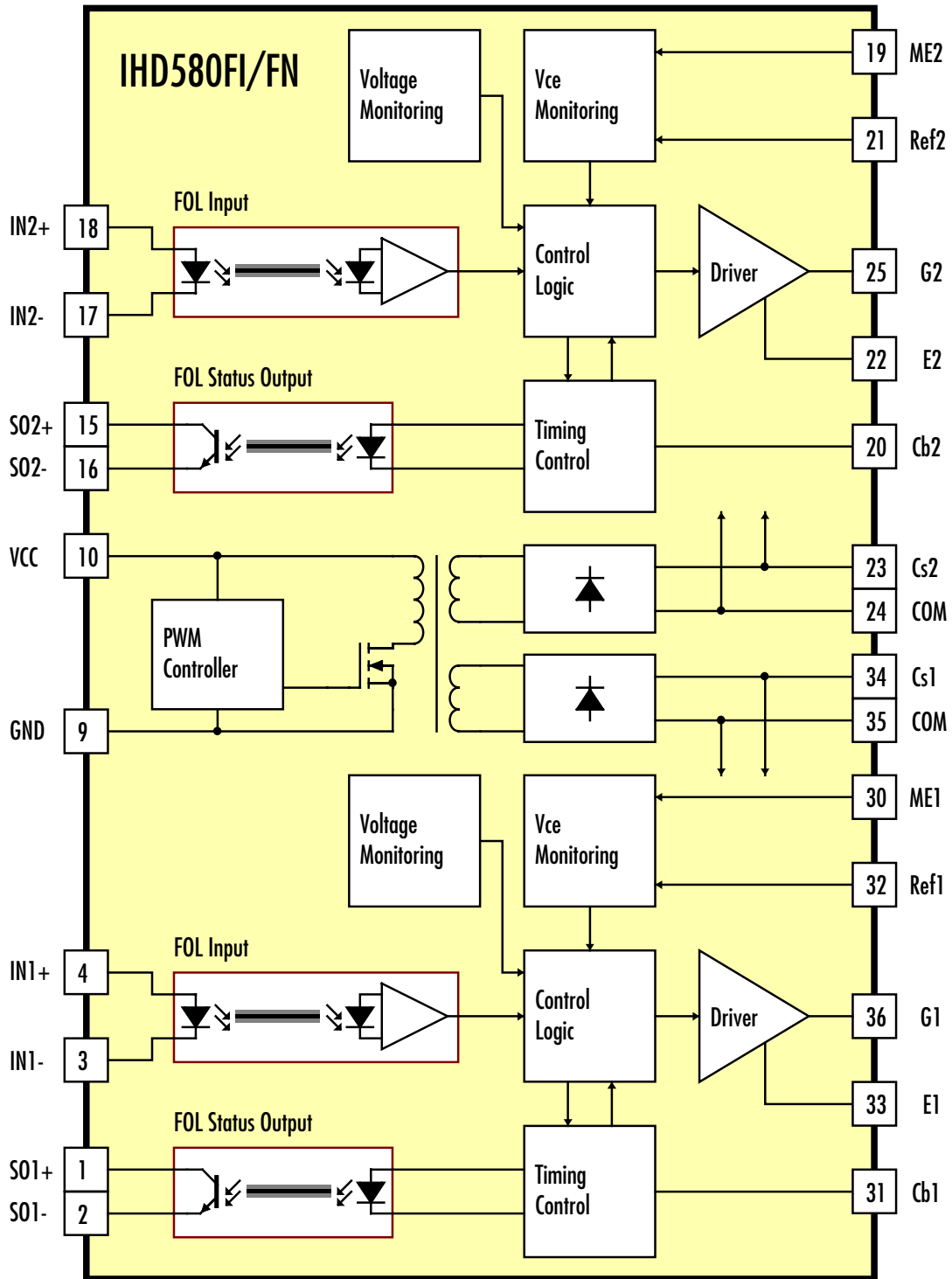


Fig. 1 Block and Connection Diagram of Half-Bridge Driver IHD580FI/FN

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General Characteristics

Parameter	Standard/Specification	typ		units
MTBF	MIL HDBK 217F (see Note 3)			
Operating temperature	IHD580FN (see Note 10)	0	+70	°C
	IHD580FI (see Note 10)	-40	+85	°C

Electrical Characteristics

Power Supply	Test Conditions	min	typ	max	units
Supply voltage V_{cc} (see Note 1)	Pin 10 to Pin 9	12	15	16	Vdc
Supply current I_{cc} (see Note 2)	without load		100		mA
Max. supply current I_{cc}	at maximal Load			450	mA
Efficiency η	internal DC/DC converter		80		%
Maximum output power	DC/DC converter, per channel		2,5		W

Inputs INx+ zu INx-	Test Conditions	min	typ	max	units
Input voltage V_{in} (see Note 4)			2.1	2.8	Vdc
Input current I_{in} (see Note 4)		6	10	11	mA

Timing Characteristics	Test Conditions	min	typ	max	units
Delay time input to output	turn-on $t_{pd(on)}$		200		ns
	turn-off $t_{pd(off)}$		250		ns
Delay time status output	at failure (see Note 5)	100	500		μ s

Outputs G1 and G2	Test Conditions	min	typ	max	units
Output peak current I_{out}	(Gate current)	-8		+8	A
Output rise time $t_{r(out)}$ (see Note 6)			20	40	ns
Output fall time $t_{f(out)}$ (see Note 6)			20	40	ns
Outputs SO1/SO2			1	3	mA

Electrical Isolation	Test Conditions	min	typ	max	units
Operating voltage (see Note 10)	continuous or repeated			2000	Vdc
Test voltage	(50Hz/1min) (see Note 9)			5000	Vaceff
Partial discharge extinction volt.	IEC270 (see Note 8)	3200			Vpeak

All data refer to +25°C and $V_{cc} = 15V$ unless otherwise specified

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Footnotes to the key data

- 1) At a supply voltage greater than 16V, the open-circuit voltages on the two output sides of the DC/DC converter may exceed 18V. This can lead to the destruction of the driver and protection circuits on the output side.
- 2) Only internal consumption of the drivers, static.
- 3) The MTBF (mean time between failures) is calculated to MIL HDBK 217F at an ambient temperature of 40°C, a typical load and when the driver is exposed to a current of air. Further information on reliability may be obtained from CONCEPT upon request.
- 4) The fiber-optic transmitters should always be driven by a current source or a voltage source with a pre-connected resistor to limit the transmitter current to between 10 and 11 mA (see Fig. 2). The inputs must never be connected directly to a low-resistance driver.
- 5) In the event of a fault, the driver turns the power semiconductor off almost without a delay. The acknowledgement traverses the fiber-optic link that has a transit delay of about 100 μ s. When the fault message arrives at the control side therefore, the power transistor has already been in the turned-off state for 100...500 μ s.
- 6) At a load of 50 nF in series with 5 Ohm.
- 7) Maximum continuous or repeatedly-applied DC voltage or peak value of the repeatedly-applied AC voltage between the inputs and outputs as well as between the power supply inputs and all other terminals and between output 1 and output 2. However, types rated and selected for higher partial-discharge voltages are also available (see note 8).
- 8) The partial discharge is not measured for the standard types. For main power applications, a sufficient safety margin exists between the typical operating voltage of < 600Vdc and the partial discharge extinction voltage of typically about >3000Vpeak. Tested and selected types with guaranteed partial-discharge immunity can be supplied for applications with maximum requirements and higher operating voltages (such as railroad applications).
- 9) The test voltage of 5000 Vac(rms)/50Hz may be applied only once during a minute. It should be noted that with this (strictly speaking obsolete) test method, some (minor) damage occurs to the isolation layers due to the partial discharge. Consequently, this test is not performed at CONCEPT as a series test. In the case of repeated isolation tests (e.g. module test, equipment test, system test) the subsequent tests should be performed with a lower test voltage: the test voltage is reduced by 500V for each additional test. The more modern if more elaborate partial-discharge measurement is better suited than such test methods as it is almost entirely non-destructive.
- 10) The application-specific self-heating of the drivers - specially at high load - must be taken into account. The module has a self-heating of 20°C in absolutely still air (at its warmest internal point). The self-heating can increase, depending on the load on the driver. If the drivers are exposed to a strong air current, the self-heating is reduced by up to about 66%. The maximum ambient temperature is obtained from the maximum operating temperature of +85°C for the IHD 580 FI (or +70°C for the IHD 580 FN) less the self-heating. CONCEPT can perform measurements of the self-heating for critical applications when the load (IGBT types and input capacitance) and clock frequency are specified.

Functional Description

Overview

The IHD580Fx intelligent half-bridge drivers are very compact drive modules designed for power MOSFETs and IGBTs in switching operation at high isolation voltages.

With the IHD 580 Fx types, signal transmission is via fiber-optic link (FOL) with a length of 20 mm integrated into the driver modules (see Fig. 1). One fast fiber-optic link is used in each channel for transmitting the drive information. The status acknowledgement is performed by means of slower fiber-optic link.

A transformer with high insulating strength is used for the DC/DC converter.

Protection function

The protection function and pin assignment are identical to those of the standard types. The description given in the data sheet IHD215/280/680 applies, with the following exception:

As the drive information is generated statically, the IHD 580 Fx types turn the power semiconductors on again automatically after a fault (short circuit or desaturation of the IGBT) after the blocking time has elapsed if the drive information is still present (for a description, see data sheet IHD 215/280/680). In contrast, the standard IHDs turn the components on again only at the next positive turn-on

edge. When a fault occurs, the drive signals should be turned off by the control logic for about one second (to ensure the thermal protection of the IGBTs).

Pin 3 and 4 {Pin 17 and 18} Inputs IN1+ and IN1- {IN2+ and IN2-}

The inputs should be driven with a current of between 10 and 11 mA. A 1k Ω dropping resistor should be used for driving at 15 V. We recommend that an RC section with 470 Ω and 220 pF be connected in parallel with the dropping resistor (see Fig. 2). The inputs must never be connected directly to a low-resistance driver.

For technical reasons, an inverting drive circuit such as shown in Fig. 2 of the data sheet IHD215/280/680 is not possible with the IHD 580 Fx types. The INx+ inputs must have a positive voltage with respect to INx- to allow the IGBT to be driven. To ensure protection against negative input voltages at the INx+ inputs, anti-parallel diodes are connected between INx+ and INx- (see Fig. 2). The IGBT is turned off by a negative input signal.

The lead configuration is less critical than for the IHD215/280/680. Likewise, the static information transfer means that no special precautions need be taken in the event of short pulses.

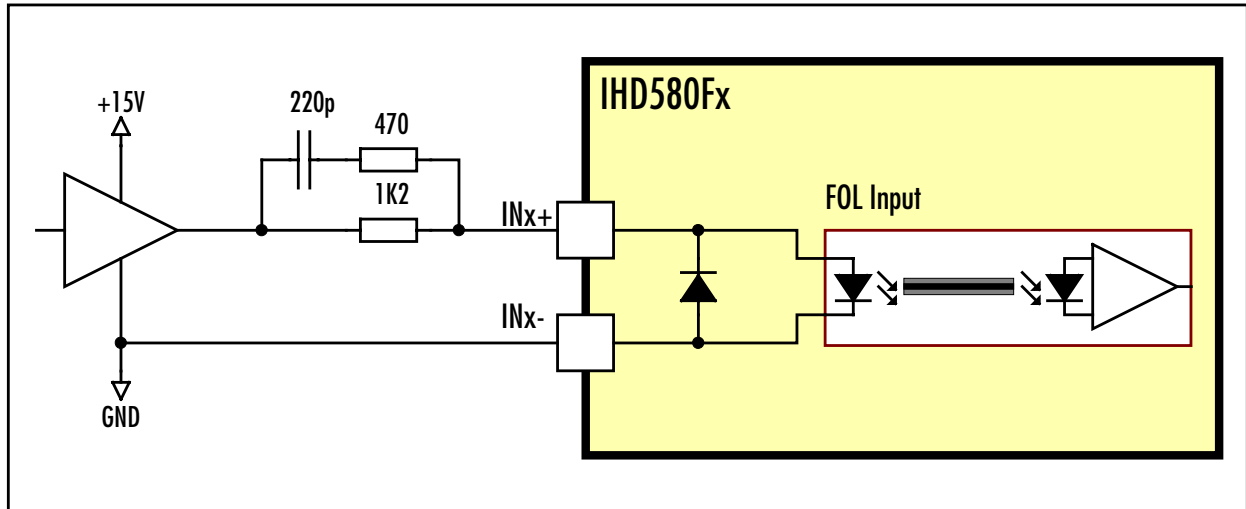


Fig. 2 Recommended input circuit for 15V input voltage level

**Pin 1 and 2 {Pin 15 and 16}
Outputs SO1+ and SO1-
{SO2+ and SO2-}**

The outputs SO1+ and SO1- are used for status acknowledgement. These are the collector (SO1+) and emitter (SO1-) of a Darlington transistor that represents the receiver of the fiber-optic link. The Darlington stage allows a voltage of up to 1 V at the through-switched transistor. An operating current of between 1 and 3 mA is recommended.

The great distance between the transmitter and receiver in the fiber-optic link means that there is no relevant capacitive coupling. The status outputs do not therefore require any additional filtering.

Higher isolation

Driver types with higher operating and isolation voltages and types that have been tested for partial discharge are available upon request.

Evaluation boards

H-bridge and 3-phase-bridge evaluation boards with 1700V IGBT modules are available specifically for IHD580Fx applications. Do not hesitate to request further information.

Exclusion Clause

CONCEPT reserves the right to make modifications to its technical data and product specifications at any time without prior notice. The general terms and conditions of delivery of CT-Concept Technology Ltd. apply.

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Ordering information

Version	Order Number
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Standard version (0...70°C)	IHD 580 FN
Industry version (-40...+85°C)	IHD 580 FI

Other Products and Information

Drivers for higher isolation voltages (i.e. railroad applications)

Please request further information

Other intelligent Drivers (Half-Bridge Drivers, Single Channel Drivers etc.)

Please ask for an overview of our intelligent drivers

Evaluation boards

Please ask for an overview of our evaluation boards

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