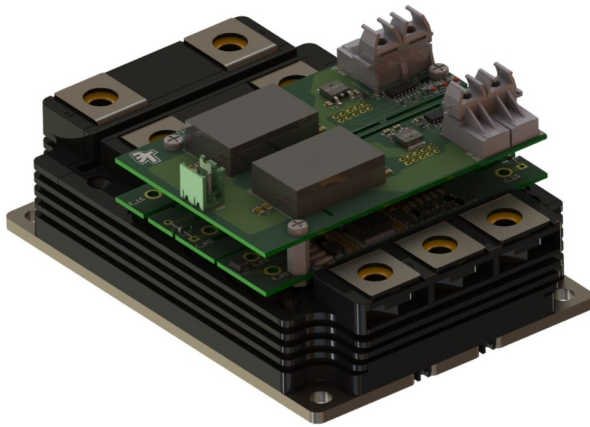




### Typical application

- Converters for solar and wind energy
- Uninterruptible Power Supply (UPS)
- Electric transport
- Frequency converter
- Active rectifiers

DI216-17-O-1 two-channel plug and play IGBT driver designed for IGBT modules type MIXM and voltage up to 1700 V.

### Features

- Two channel IGBT driver
- Drives IGBTs up to  $V_{CE} = 1700V$
- Gate peak current  $I_{OUT} \pm 16 A$
- Gate output voltage  $V_{OUT} +15/-9 V$
- Optical control interface
- Isolation testing voltage 4 kV AC
- Frequency PWM up to 15 kHz
- IGBT short-circuit protection with soft switch-off
- Power-supply monitoring (UVLO)
- Compact design 100x67x38 mm

### Maximum rated values

| Definition                | Symbol        | Conditions                                | Value     | Unit        |
|---------------------------|---------------|-------------------------------------------|-----------|-------------|
| Supply voltage $V_{CC}$   | $U_{SUP}$     |                                           | 15.5      | V           |
| Logic input voltage       | $U_{IN\_A/B}$ |                                           | 15.5      | V           |
| Gate peak current         | $I_{OUT}$     |                                           | $\pm 16$  | A           |
| Frequency PWM             | $f_{SW}$      | Gate charge $Q_G = 10200 \mu C$           | 15        | kHz         |
| Isolation voltage         | $U_{ISOL}$    | First to second side, 60 sec              | 4000      | V rms       |
| Output power              | $P_{OUT}$     | For 1 channel                             | 3.6       | W           |
| dV/dt                     | dU/dt         | Rate of change of input to output voltage | 50        | kV/ $\mu s$ |
| DC-link voltage           | $U_{DC}$      |                                           | 1100      | V           |
| Collector-Emitter voltage | $U_{CE}$      |                                           | 1700      | V           |
| Operating temperature     | $T_{OP}$      |                                           | -40...+85 | °C          |
| Storage temperature       | $T_{STOR}$    |                                           | -40...+85 | °C          |

### Characteristics

| Definition                                                   | Symbol        | Conditions                                                | Value |      |      | Unit    |
|--------------------------------------------------------------|---------------|-----------------------------------------------------------|-------|------|------|---------|
|                                                              |               |                                                           | min.  | typ. | max. |         |
| Supply voltage $V_{CC}$                                      | $U_{SUP}$     |                                                           | 14.5  | 15   | 15.5 | V       |
| UVLO threshold                                               | $U_{UVLO}$    | Switch-off threshold 13.7 V<br>Switch-on threshold 14.3 V | 13.7  |      | 14.3 | V       |
| Supply current $I_{CC}$                                      | $I_{S(idle)}$ | Without load                                              |       | 240  |      | mA      |
| Average supply current                                       | $I_{S(max)}$  | $f_{SW} = 15 \text{ kHz}$ $Q_G = 10200 \text{ nC}$        |       | 690  |      | mA      |
| Turn-on output voltage                                       | $U_{G(on)}$   |                                                           |       | 15   |      | V       |
| Turn-off output voltage                                      | $U_{G(off)}$  |                                                           |       | -9   |      | V       |
| The wavelength used in transmitting and receiving the signal | $\lambda$     |                                                           |       | 660  |      | nm      |
| $V_{CE}$ monitoring threshold                                | $U_{CE(ref)}$ |                                                           |       | 8.2  |      | V       |
| Response time                                                | $t_{bl(VCE)}$ |                                                           |       | 8    |      | $\mu s$ |
| Error signal activation delay time                           | $t_{bton}$    |                                                           |       | 500  |      | ns      |
| Channel control lockout time                                 | $t_{btoff}$   |                                                           |       | 1    |      | ms      |



| Definition                                    | Symbol          | Conditions | Value |      |      | Unit     |
|-----------------------------------------------|-----------------|------------|-------|------|------|----------|
|                                               |                 |            | min.  | typ. | max. |          |
| Turn-on gate resistor                         | $R_{G(on)}$     |            |       | 1    |      | $\Omega$ |
| Turn-off gate resistor                        | $R_{G(off)}$    |            |       | 1    |      | $\Omega$ |
| Creepage distance primary to secondary side   | $l_{clear(PS)}$ |            |       | 7.7  |      | mm       |
| Creepage distance secondary to secondary side | $l_{clear(SS)}$ |            |       | 5.8  |      | mm       |
| Weight                                        | W               |            |       | 91   |      | g        |

## Operating modes of the driver

### 1. Normal operation

In the normal operation mode of the driver, when a light pulse is applied to the optical input of the upper and lower channels (HS/LS), IGBT is turned on. In case of an emergency, the LED of the optical output stops glowing. The control input signal is blocked until the cause of the emergency situation is eliminated. A diagram explaining the operation of the driver is shown in Figure 1.

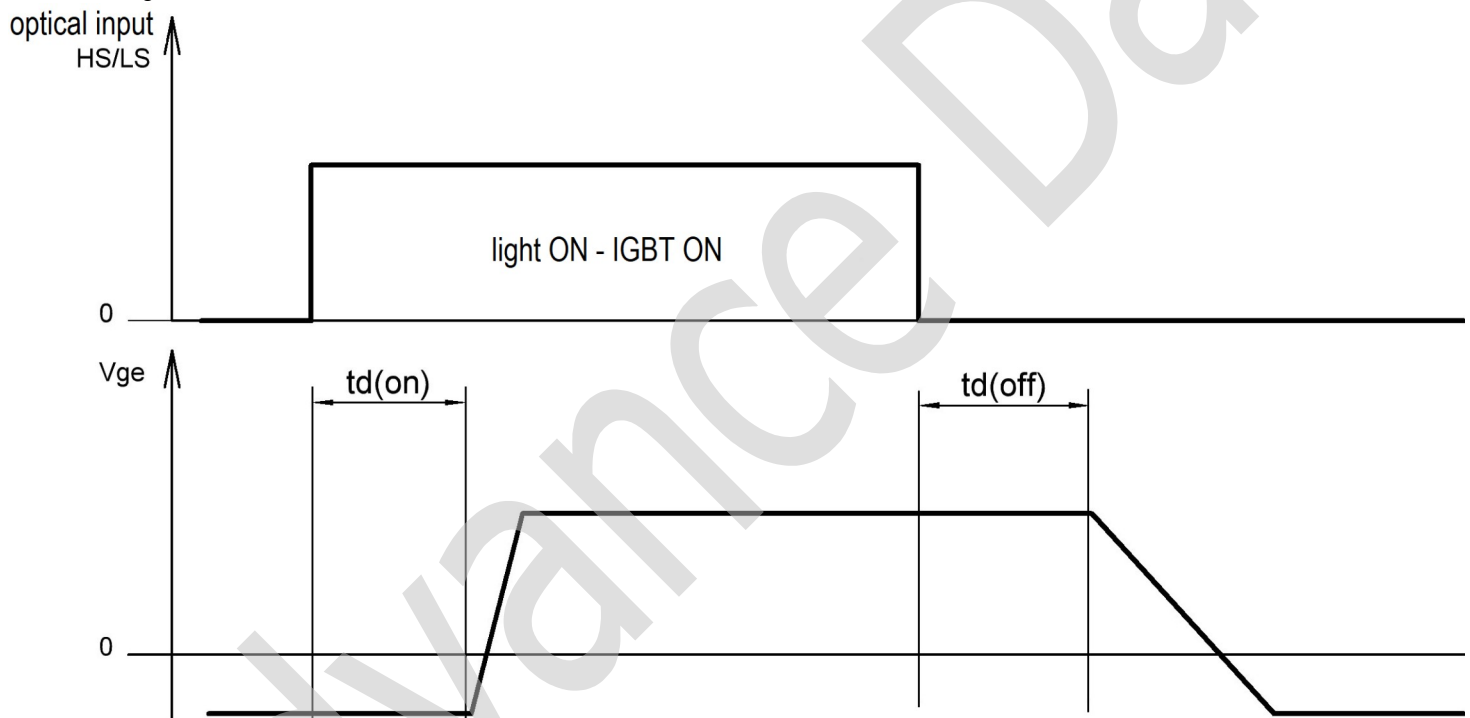


Figure 1 — Normal operation mode of the driver

### 2. The occurrence of errors

If an abnormal situation occurs, the ERROR HS/LS optical output stops signaling. The occurrence of an emergency situation is possible for one or more reasons:

1. Low supply voltage of the upper (HS) or lower channel (LS).
2. Over-current accident (DESAT).
3. An accident caused by exceeding the temperature of the  $R_{TD}$  module substrate.

#### 2.1 Operating mode of UVLO

If the USUP supply voltage drops below +13.7 V, the driver enters an error state and blocks the control input signals, the IGBT module will be turned off via the gate resistor  $R_g$  off. To exit the error state, it is necessary to raise the USUP supply voltage to a value of +14.3 V.



## 2.2 DESAT circuit mode

The DESAT circuit is a driver protection circuit that protects the IGBT module from high-amplitude currents. The delayed  $t_{bl(VCE)}$  circuit, after starting to turn on the IGBT, begins to control the voltage drop of the IGBT transistor between the collector-emitter terminals. If the voltage drop exceeds the  $U_{CE(ref)}$  value, the driver will turn off the IGBT module using the "soft" shutdown function and block the control input signals for the duration of  $t_{btoff}$ . The ERROR HS/LS driver output will be converted to an error state. Figure 2 shows a diagram of the operation of the DESAT protective circuit.

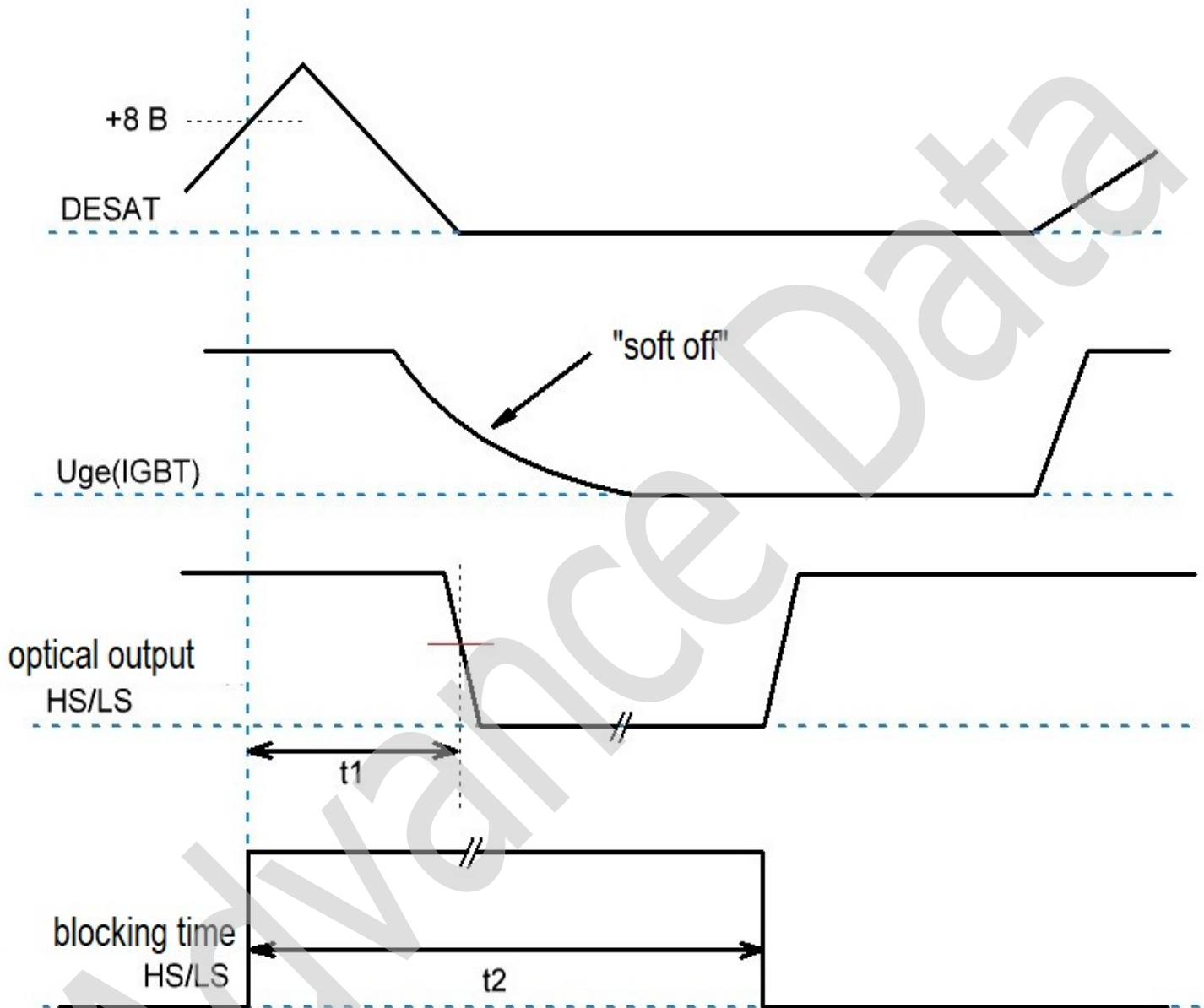


Figure 2 — DESAT protection circuit

t1 – error enable delay time  $t_{bton}$  500 ns

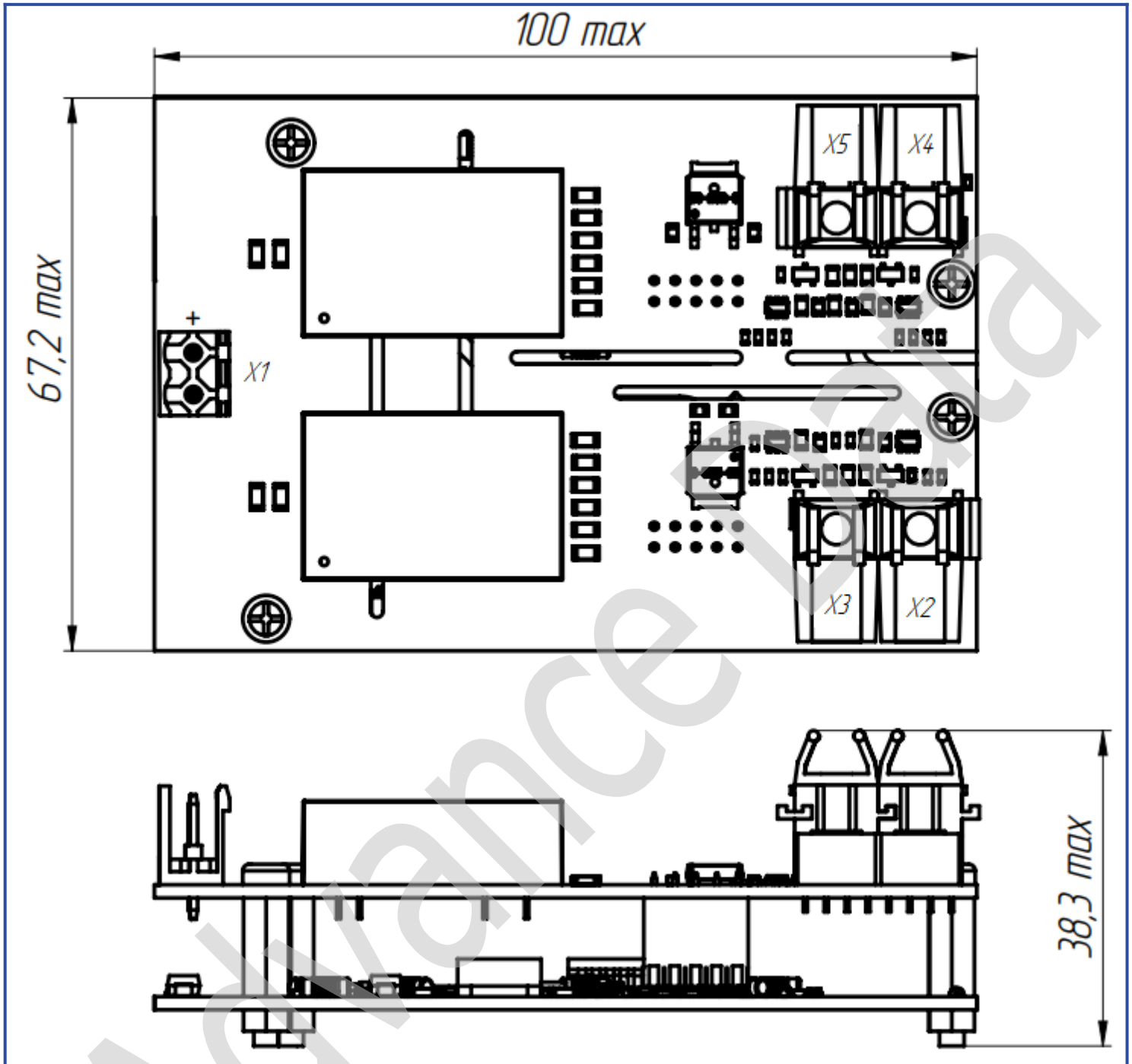
t2 – channel control lock time  $t_{btoff}$  1 ms

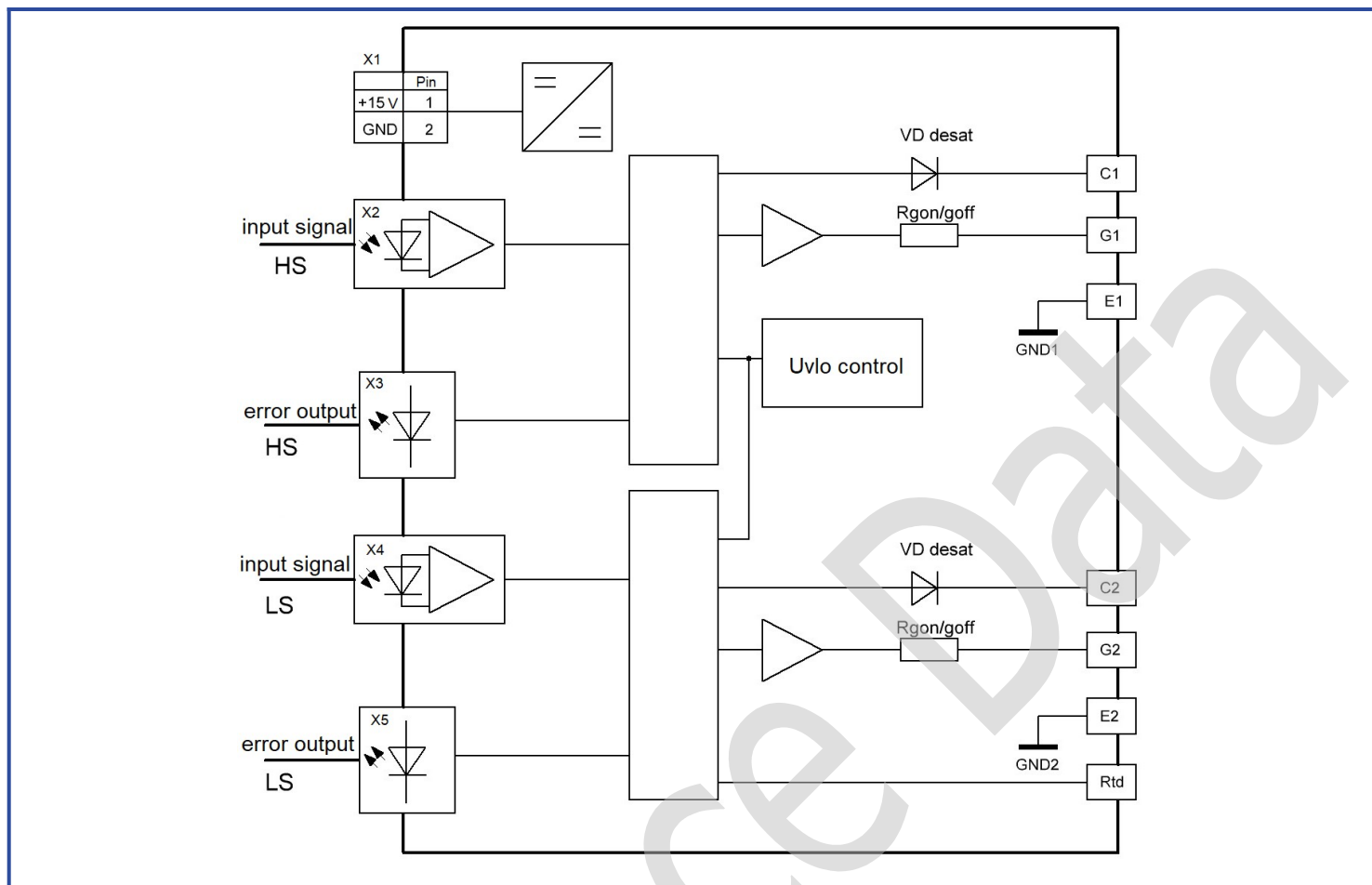
## 2.3 Over-temperature protection

Over-temperature protection is implemented by monitoring the readings of the module's NTC thermistor. If the NTC resistance of the RTD thermistor falls below the threshold value, the driver will enter an error state and block control. The error will be reset automatically when the resistance of the NTC thermistor corresponding to the permissible temperature is reached.



Overall dimensions



**Functional diagram**

**Pin Designation (X1 - 2EDGV-5.08-02P-1-4)**

| № pin | Input connector    | № pin | Входной разъем |
|-------|--------------------|-------|----------------|
| 1     | Power supply +15 V | 2     | GND            |

**Pin Designation (HFBR-2531Z)**

HFBR-2531Z connector (X2 – high channel, X4 – low channel) is the receiver of the control input signal.

**Pin Designation (HFBR-1531Z)**

The HFBR-1531Z connector (X3 — high channel, X5 — low channel) is an error signal transmitter.

**Part numbering guide**

| DI | 2 | 16 | - | 17 | - | 0 | - | 1 |                                    |
|----|---|----|---|----|---|---|---|---|------------------------------------|
| DI |   |    |   |    |   |   |   |   | IGBT driver                        |
|    | 2 |    |   |    |   |   |   |   | Number of Output Channels          |
|    |   | 16 |   |    |   |   |   |   | Maximum pulse output current       |
|    |   |    |   | 17 |   |   |   |   | IGBT module class                  |
|    |   |    |   |    |   | 0 |   |   | Optical interface                  |
|    |   |    |   |    |   |   |   | 1 | Version for IGBT modules type MIXM |

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