

DH-M-5 Datasheet

Abstract

The DH-M-5 driver is the world's first driver designed for ten parallel-connected Infineon XHP™ modules. Based on Firststack's "Driver Hub" technology, the current sharing can be easily achieved by less than 3%.

Integrated design, greatly improving the system reliability, suitable for traction, HVDC and other high reliability applications.

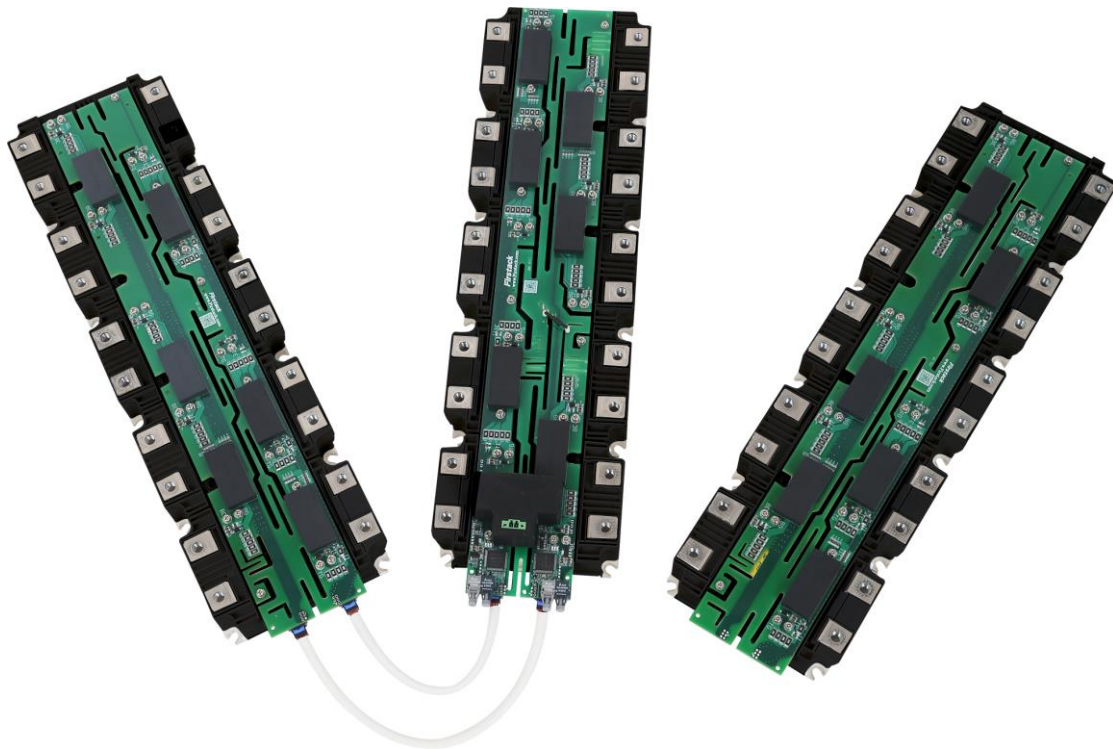


Fig.1 DH-M-5

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System Diagram

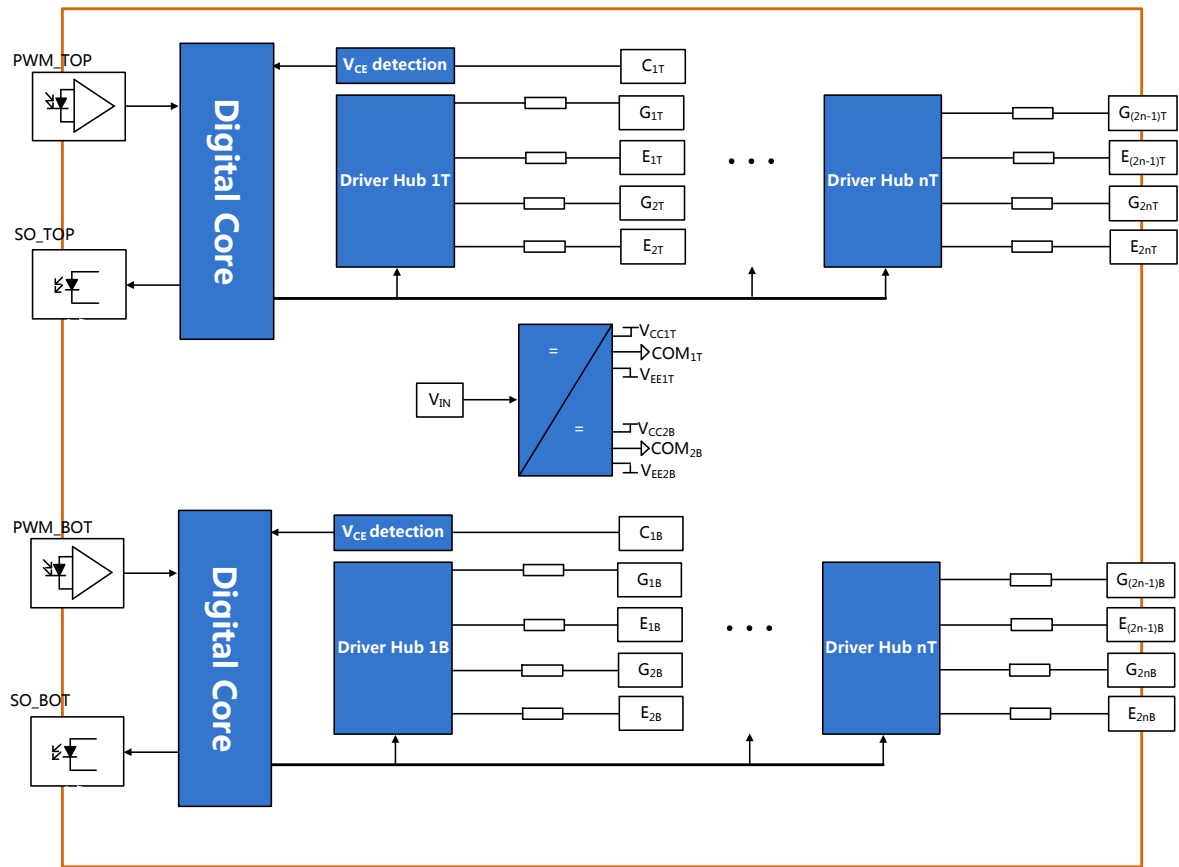


Fig.2 Block diagram of DH-M-5

Using steps and precautions

The following steps pointed out the easy way to use DH-M-5 drivers:

1. Choose a suitable driver

When applying DH-M-5 drivers, you should note that they are specifically adapted to a particular type of IGBT module. These drivers are not valid for IGBT modules other than those specified. Incorrect use may result in failure.

2. Attach the drivers to the IGBT modules (one driver per IGBT module)

Any handling of IGBT modules or drivers is subject to the general specifications for protecting electrostatic-sensitive devices according to international standard IEC 60747-1, Chapter IX or European standard EN 100015 (i.e. the workplace, tools, etc. must comply with these standards).



If these specifications are ignored, both IGBTs and drivers may be damaged.

3. Connect the driver to use the control electronics

Connect the driver connector (fiber) to the control unit and provide the appropriate supply voltage for the driver.

4. Check the driver function

Check the gate voltage of all drivers: For the off-state, the nominal gate voltage is specified in the relevant data sheet. For the on-state, it is +15V. Also check the input current consumption of the driver without clock signal and at the desired switching frequency. After the Firstack digital drivers are provided the appropriate supply voltage, the status indicator TEST displays a green light

These tests should be performed before installation, as the gate terminals may otherwise not be accessible.

5. Set up and test the power stack

Before starting up the system, it is recommended to check each IGBT module with a single pulse or double pulse test method. Firstack recommends that the user need to ensure that the IGBT module does not exceed the operating range specified by the SOA even under the worst conditions, because it relies on the specific converter structure.

Mechanical Dimensions

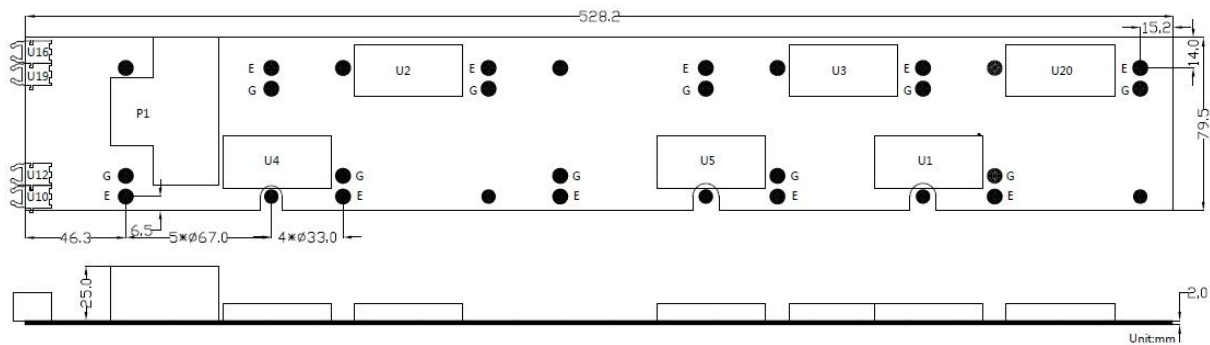


Fig. 3 mechanical Dimensions

Connector manufacturers and models

No.	Label	Manufacture	Ordering Number
1		Würth	691325310002
2	PWM	Avago	HFBR-2412TCZ/HFBR-2521
3	FAULT	Avago	HFBR-1412TMZ/HFBR-1521Z

Pin Destination

Pin	Destination	Remarks	Pin	Destination	Remarks
	V _{CC}	Input Voltage		GND	Primary GND

LED Indicator

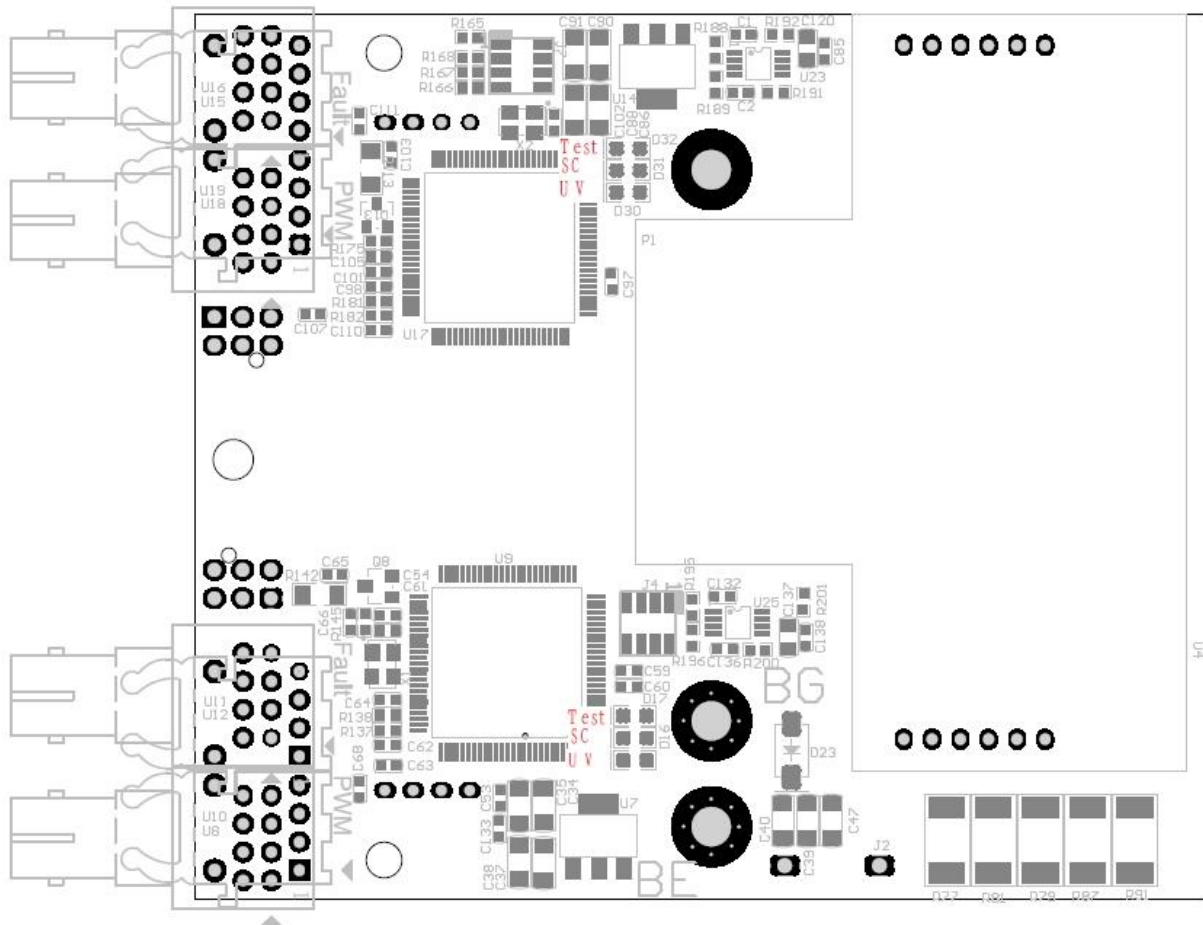


Fig. 4 LED indicator

Firststack driver has LED indicators for monitoring the working status of the driver and the converter. The following is the LED status description.

LED Status Indicator

NO.	Location	Lable	Remarks
1	D15 , D30	UV	UV on, unless driver restarted
2	D16 , D31	SC	SCon, unless driver restarted
3	D17 , D32	TEST	No fault on

Parameters

Absolute Maximum Ratings

Parameter	Remarks	Min	Max	Unit
V_{IN}	To GND		28	V
I_{PEAK}			100	A
Single output power	$T_A = 85^\circ\text{C}$		10	W
Test Voltage(50Hz/1min)	Primary to secondary		10.2K	V_{RMS}
	Secondary to secondary		10.2K	V_{RMS}
Operating temperature		-40	+85	$^\circ\text{C}$
Storage temperature		-40	+85	$^\circ\text{C}$

Recommended Operating Condition

Parameter	Remarks	Min	Typ	Max	Unit
V_{IN}			15	28	V

Electrical Characteristics

Power Supply	Remarks	Min	Typ	Max	Unit
Supply current	No load		0.5		A
Coupling capacitance	Primary to secondary		8		pF
Power Supply Monitoring					
Supply Threshold V_{IN-GND}			12.5		V
Short-Circuit Protection					
V_{CE_ref} monitoring threshold			10.2		V
Response time			8		us
Blocking time			90		ms
Timing Characteristics					
Turn-on delay			450		ns
Turn-off delay			450		ns
Rise time			15		ns
Fall time			12		ns
Fault hold time			30		us

Unless otherwise noted, all data are tested based on + 25 ° C ambient temperature and $V_{IN} = 15V$

Main Function

◆ Short-circuit Protection—— V_{CE} monitoring

V_{CE} is checked after the response time at turn on to detect a short circuit

If V_{CE} is higher than the programmed threshold V_{TH} , the driver detects a short circuit at the IGBT, then the driver will start soft shut down and the IGBT will be turned off slowly.

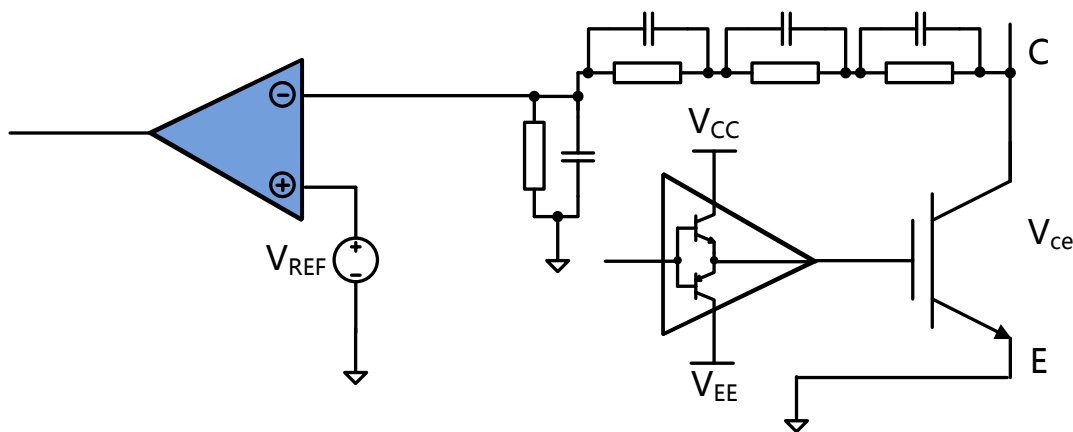


图 6 V_{CE} detection circuit

◆ Under Voltage Protection

The driver's secondary-side has under voltage monitoring circuit. When under voltage happens, the driver will turn off the IGBT and send out the fault signal.

The lower V_{GE} will increase the IGBT switching losses. Intelligent Driver recommended that any IGBTs in the bridge arm should not work under under-voltage condition.

◆ Soft shut-down

When a short circuit occurs, IGBT will quickly desaturation, the voltage V_{CE} will reach the DC bus voltage. Depending on the type of IGBT and gate voltage, I_C will reach 4 times the rated current, or even more.

At this time, IGBT power loss will instantly reach megawatt. If the short-circuit current can not be reduced in a very short time, the IGBT will be damaged because of overheat. However, if the turn-off speed is as fast as the normal shutdown, it will produce a large di/dt . Due to the parasitic inductance, the V_{CE_spike} will be very high, it maybe damage the IGBT.

In order to solve the high V_{CE_spike} , Firststack Intelligent Driver use the soft shut down technology. When the IGBT short circuit happen, that the total turn off time is controlled under 10us, by slowly lowering the gate voltage V_{GE} , it is ensured that the IGBT chip will not be damaged by overheat and over voltage, and ensure the safety of IGBT.

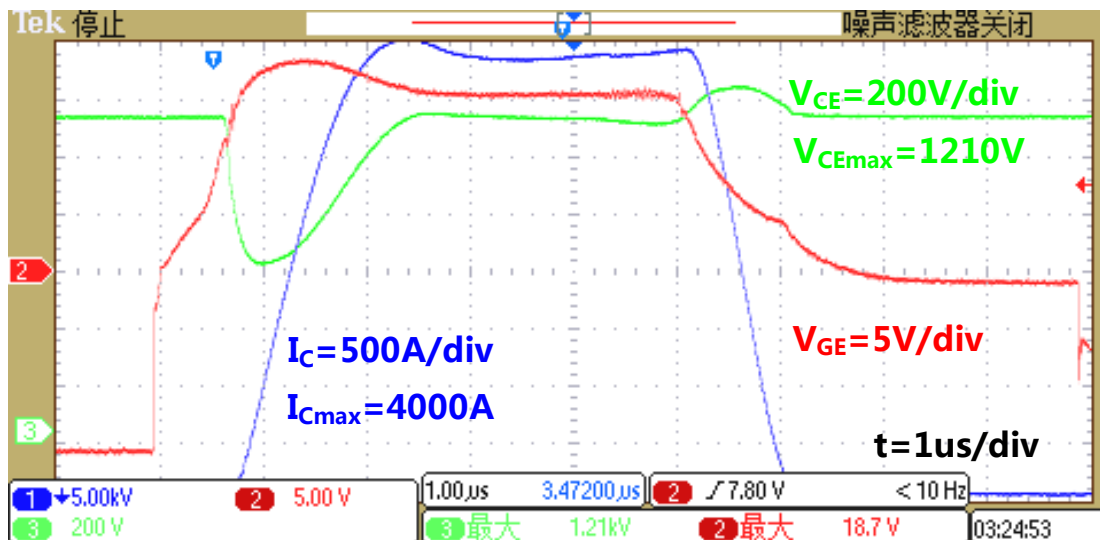


Fig. 7 Short-circuit waveform of FF1000R17IE4 under 1100V

Figure 7 shows the short circuit waveform of the 1700V / 1000A IGBT (FF1000R17IE4) controlled by the Firststack IGBT driver circuit at 1100V V_{DC} the I_{sc} is 4000A, the role of ssd I_c down slowly and V_{CE} almost no overshoot, shut down the IGBT effectively and safely.

◆ Immortal Driver

Since it is necessary to reduce the coupling capacitance C_{PS} of the primary and secondary sides as much as possible, the DC/DC of the driver works at

open loop mode, So it is difficult to integrate overcurrent protection and other functions, which leads weak overload capacity. Almost all drivers' failure is associated with DC / DC failure.

In order to improve the reliability of the driver, Firststack intelligent driver proposed an "Immortal Driver" concept. The driver can withstand GE short circuits .

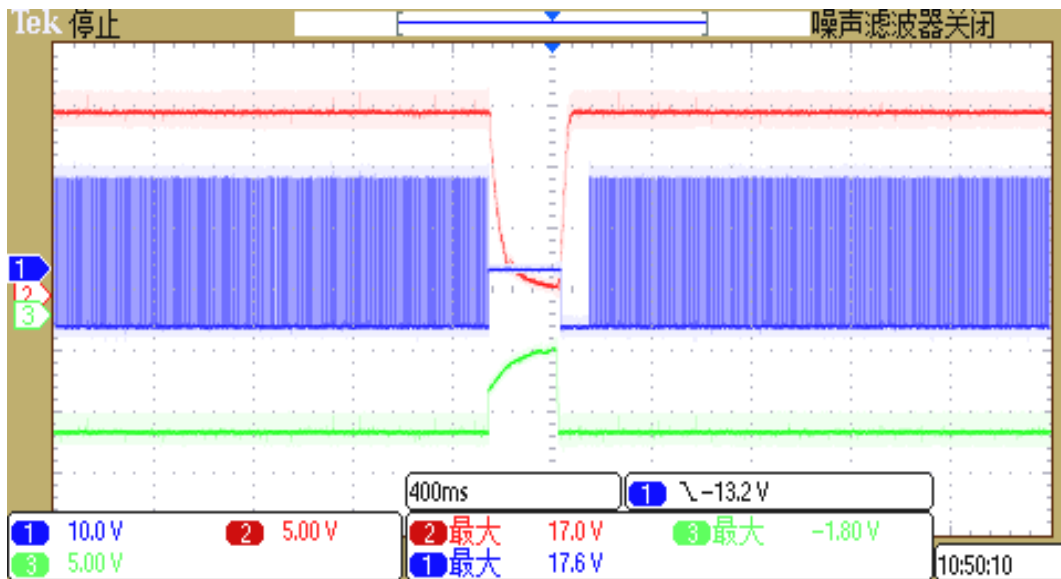


Fig. 8 GE short circuit

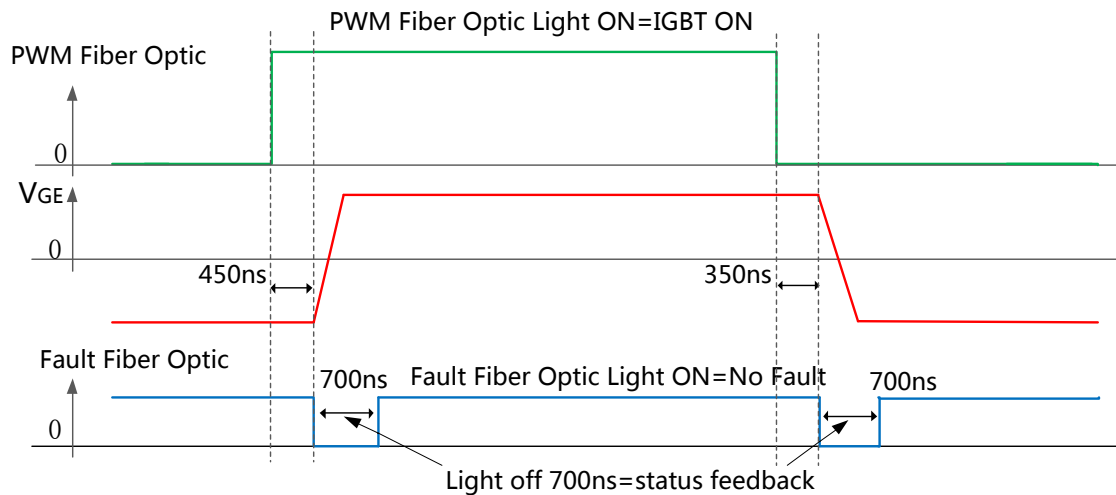
As shown in Fig. 8 , CH1 (blue) = V_{GE} , CH2 (red) = +15V(secondary side) , CH3 (green) = -10V(secondary side).When an overload occurs, the driver will block the PWM signal, and send fault signal to the master. And after overload removed, the driver can work normally.

◆ Fiber-optic output

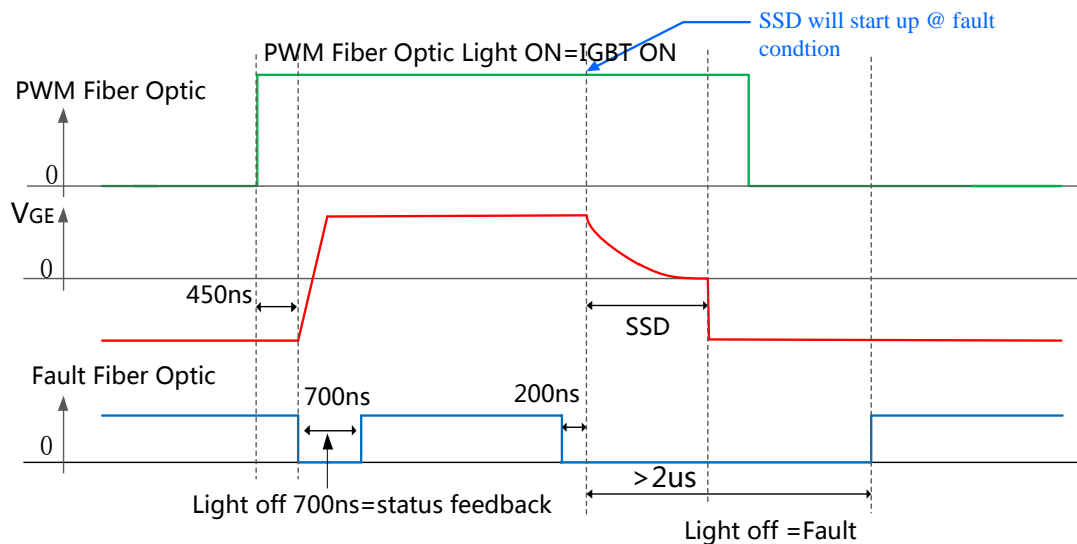
Many problems may be exist in the use of fiber optics , such as fiber port buckle is not firmly / off, optical fiber bending radius is not enough. To ensure the normal work of the fiber, Firststack Intelligent Driver is equipped with an optical port response function. Details are as follow:

1、During normal operation(i.e. the driver is supplied with power at nominal voltage, and there is no fault anywhere) , the status feedback is given by a

“light off” once receive a PWM signal. Each edge of the control signal is acknowledged by the driver with a short pulse (the light is off for a period of about 700ns), the following shows the control and response signals of the gate driver in normal operation.



2、 When the driver monitors a fault signal, the light of Falult Fiber Optic will be turned off for more than 2us, as a fault signal feedback to the master.



By measuring the time of the fiber optic light-off, the host can distinguish between response information and fault information accurately.

Technical Support

Any questions about business advice, technical support, product selection and other related information are guaranteed to be answered within 48 hours by Firststack professional team.

24h Technical & Services hot line : 4001-577-522

Legal Disclaimer

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