2FHD0225 Data Sheet

Abstract

The 2FHD0225 series drivers are high-performance dual-channel, plug-and-play gate drivers independently developed by Firstack based on proprietary intelligent-chip technology. They are designed for EconoDUAL™ modules with voltage ratings up to 1700 V.

Each channel supports up to 2 W output power and integrates comprehensive protection functions as well as intelligent fault diagnosis and feedback capabilities, ensuring high reliability and safe operation in demanding power electronics applications.

Core Features:

- 2W output per channel
- Support up to 1700V ED3 module
- SC protection with SSD
- Miller Clamping
- Fault Feedback
- UVLO

Typical Application:

- SST（Solid State Transformer）
- Auxiliary Converter
- Motor Drive

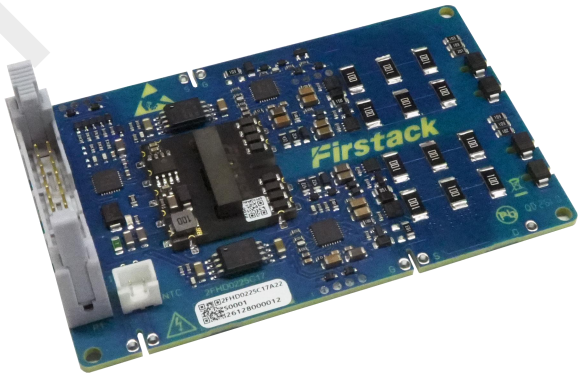


Fig. 1 2FHD0225

Functional Block Diagram

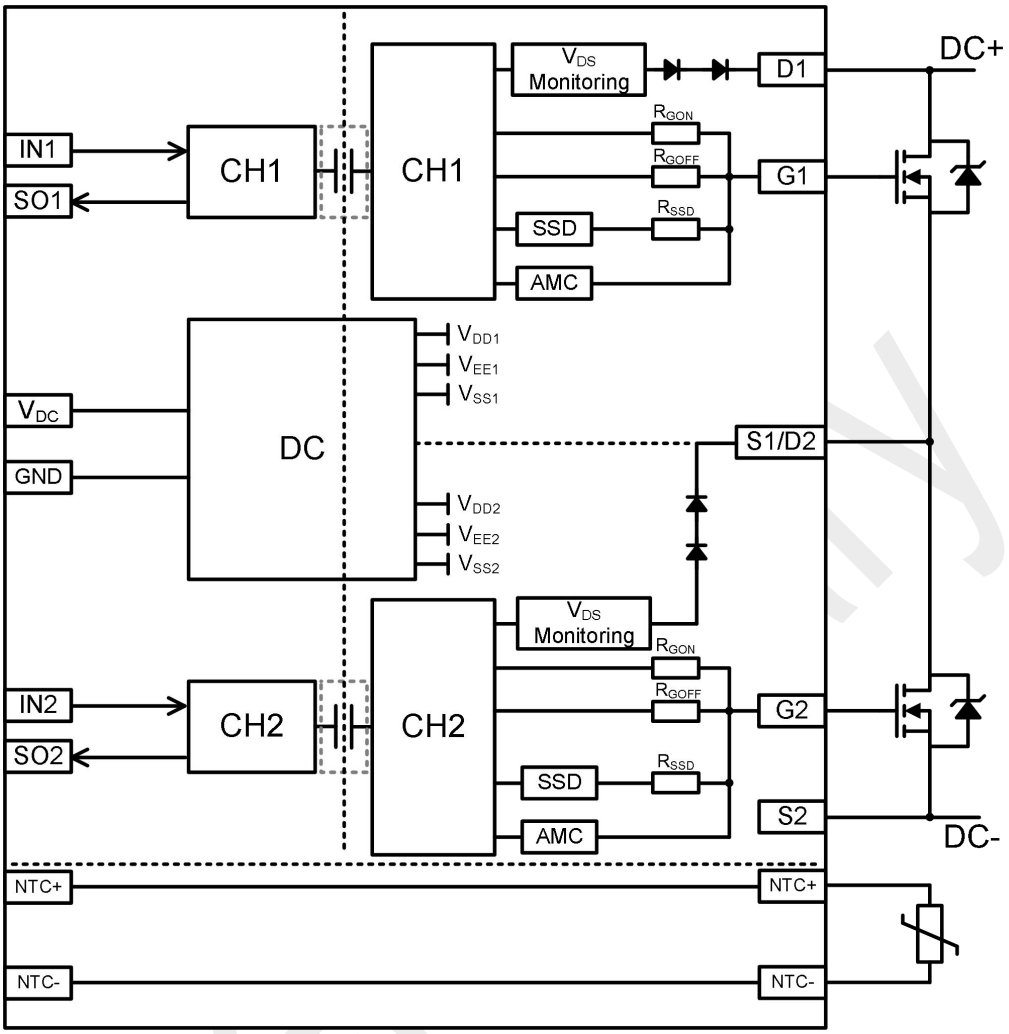


Fig. 2 Functional Block Diagram

Layout

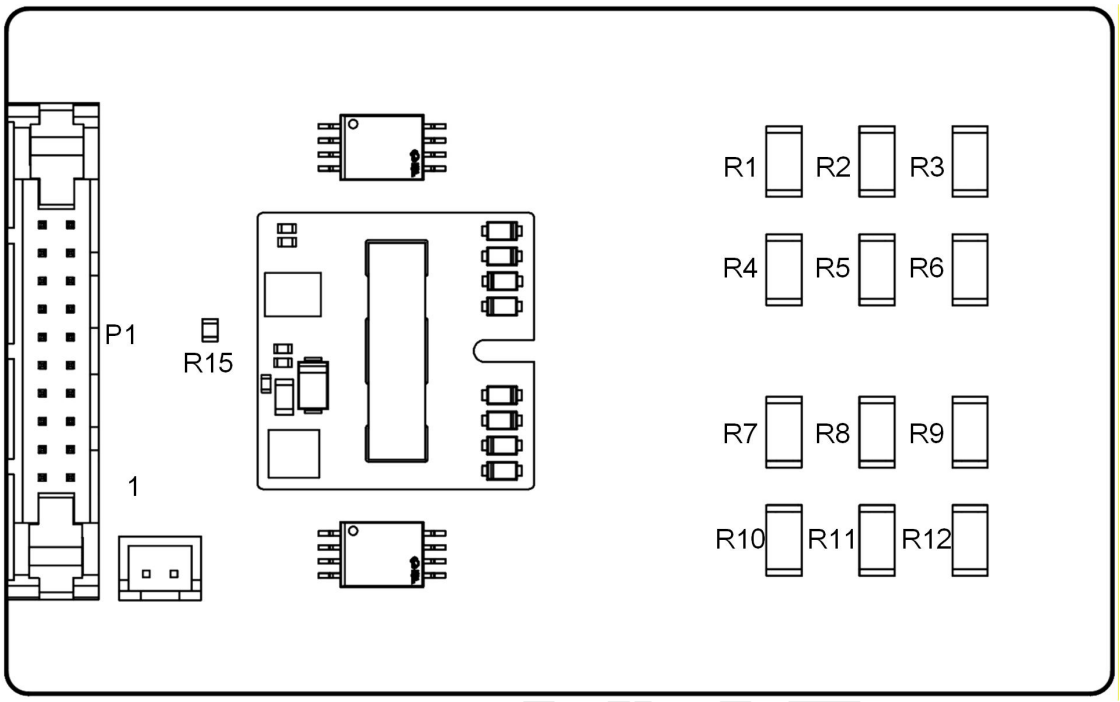


Fig. 3 Key Components Position

Resistances Replacement

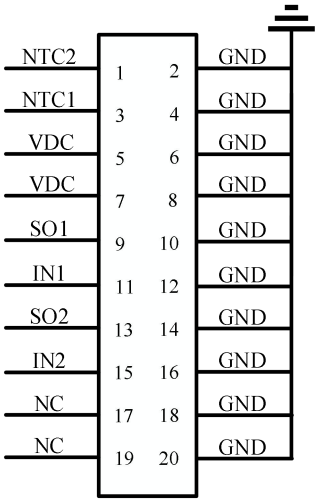
Position	Description
R4,R5,R6 & R7,R8,R9	ON
R1,R2,R3 & R10,R11,R12	OFF
R15（Note 1）	Feedback Resistance

Note 1： The secondary-side total output voltage can be adjusted by changing the resistance value of R15. When R15 is not populated, the total secondary voltage is 20.85 V. When R15 = 51 kΩ, the total secondary voltage is 22.8 V. If additional output voltage levels (VOUT≤23V) are required, they can be calculated using the following formula:

$$\text{(1)} \quad A = \frac{\frac{8}{15} \times 200k\Omega}{V_{OUT} + \frac{1}{15}}$$

$$\text{(2)} \quad R_{15} = \frac{5.1k\Omega \times (A - 3.57k\Omega) + A \times 3.57k\Omega}{5.1k\Omega - A}$$

Connector Interface Definition



Pin Definition

Pin	Definition	Description	Pin	Definition	Description
1	NTC1	NC if didn't be used	2	GND	Reference Ground
3	NTC2	NC if didn't be used	4	GND	Reference Ground
5	V_{DC}	Power source	6	GND	Reference Ground
7	V_{DC}	Power source	8	GND	Reference Ground
9	SO1	Status output of CH 1 (TOP)	10	GND	Reference Ground
11	IN1	Signal input of CH 1 (TOP)	12	GND	Reference Ground
13	SO2	Status output of CH 2 (BOT)	14	GND	Reference Ground
15	IN2	Signal input of CH 2 (BOT)	16	GND	Reference Ground
17	NC	/	18	GND	Reference Ground
19	NC	/	20	GND	Reference Ground

Note:The Pin 1 and 3 are used for NTC sampling through the 20-pin connector. If you won't use this two pins please keep NC.

Absolute Maximum Ratings

Parameter	Description	Min	Max	Unit
Supply voltage V_{DC}	to GND	0	15.5	V
Supply current I_{DC}	Full Load (2W per channel)	0.45	0.46	A
Gate peak current	@85℃	-25	25	A
Power output per channel (Note 1)	@50℃		2	W
	@85℃		1	W
Switching frequency (Note 2)	V_{GS}=18V/-4V; Qg=2μC@50℃		45	kHz
	V_{GS}=18V/-4V; Qg=2μC@85℃		22	kHz
Test Voltage (50Hz/min)	Pri. to Sec.	5000		V_{RMS}
Operating Voltage	Max. allowed V_{DS}		1700	V_{DC}
Operating Temperature		-40	85	℃
Storage Temperature		-40	85	℃

Recommended Operating Conditions

Parameter	Description	Min	Typ	Max	Unit
Supply voltage V_{DC}	to GND	14.5	15	15.5	V
Supply current I_{DC}	Without Load		0.12		A
PWM Signal	to GND (Note 3)	9.2	15	V_{DC}	V

Electrical Characteristics

Gate Driver Parameters (Note 4)

Parameter	Description	Min	Typ	Max	Unit
V_{GSon}	Gate turn on voltage	15	18	20.5	V
V_{GSoff}	Gate turn off voltage	-9.5	-4	-0.5	V

Logic of Input&Output

Parameter	Description	Min	Typ	Max	Unit
Turn on threshold	The threshold of driver IC		7.5		V
Turn off threshold			4.9		V
SOx	Fault feedback, Io<10mA	0.35		V_{DC}	V
Operating Mode	Direct Mode (default)	Set by software, no configuration required			
	Half-bridge Mode	Set by software, no configuration required			

Short Circuit Protection

Parameter	Description	Min	Typ	Max	Unit
V_{DS} monitoring threshold	When short circuit is detected		11		V
Response time (Note 5)	CH1, Note 3		1.5		μs
	CH2, Note 3		1.5		μs
Soft shut down (SSD) time	Duration of SSD		4.16		μs

Miller Clamping

Parameter	Description	Min	Typ	Max	Unit
Miller clamping delay (Note 6)	Delay	(Configurable)	1.04	(Configurable)	μs
Clamping Voltage (Note 7)			V_{SS}		V

UVLO

Parameter	Description	Min	Typ	Max	Unit
Primary side undervoltage threshold			12		V
Secondary side undervoltage threshold			12.5		V

Time Characteristics

Parameter	Description	Min	Typ	Max	Unit

Turn-on delay	(Note 8)	790 ns
Turn-off delay	(Note 9)	840 ns
Rise time	(Note 10)	11 ns
Fall time	(Note 11)	11 ns
Fault blocking time	(Note 12)	78 ms
Fault classification	Through the low level duration to classify the type of the fault (Note 13)	According to fault type ms

Electrical Isolation

Parameter	Description	Min	Typ	Max	Unit
Creepage distance (Note 14)	Pri. to sec.		8		mm
	Sec. to sec.		6.5		mm
Clearance distance (Note 14)	Pri. to sec.		8		mm
	Sec. to sec.		6.5		mm
Partial Discharge (Note 15)		1800			Vpeak

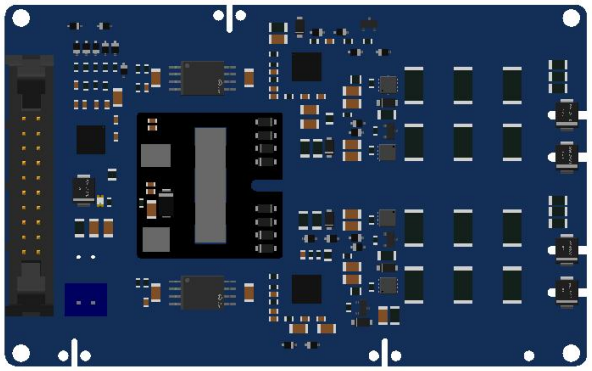
Unless otherwise specified, all data are based on tests at +25℃ ambient temperature and V_{DC}=15V.

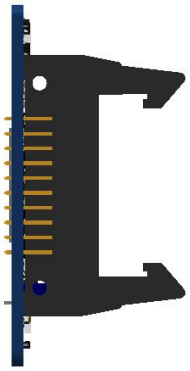
Note:

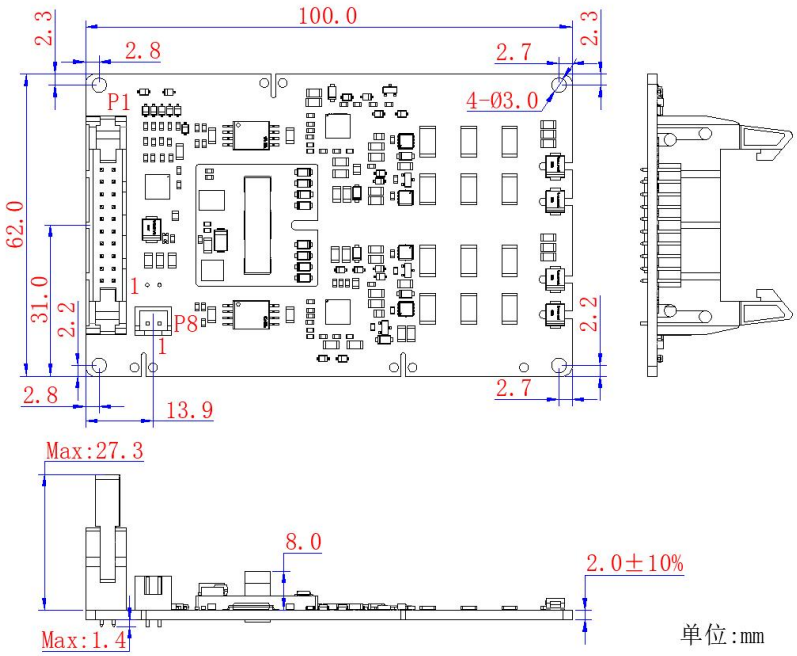
1. The output power of each channel includes the static power consumption of the driver;
2. The switching frequency is a function of ambient temperature and the gate charge (Qg) of the power module. The frequency can be estimated using the relationship f = P / Qg. In worst-case conditions, the 2FHD0225 can supply up to 3 W output power per channel under 25℃. In this case, excessive power dissipation in the gate resistor may occur, which could lead to thermal overstress and damage.
3. The recommended amplitude of the input PWM signal is 15 V. For SiC modules, a 5 V input signal is not recommended. If a 5 V input signal is required, please contact Firstack for customized solutions.
4. For detailed gate voltage parameters, please refer to the selection table. The values in the table indicate the available positive and negative gate voltage ranges provided by the driver. The sum of the absolute values of the positive and negative gate voltages must not exceed the total secondary-side voltage.

5. Response Time: The short-circuit protection response time is defined as the time interval from the occurrence of a fault to the initiation of the soft turn-off process. This time includes the fault blanking time, capacitor charging time, and filtering delay.
6. The time interval from the start of gate turn-off to the activation of the Miller clamp. A delay of 1.04 μs is generally sufficient for most practical applications. For special requirements or operating conditions that require delay adjustment, please contact Firstack for technical support.
7. The Miller clamp stabilizes the gate voltage at the driver negative supply (V_{SS}). The magnitude of the negative voltage depends on the gate output configuration.
8. Turn-On Delay Time: The time interval from the rising edge of the input PWM signal at the primary side to the rising edge of the gate signal at the secondary side.
9. Turn-Off Delay Time: The time interval from the falling edge of the input PWM signal at the primary side to the falling edge of the gate signal at the secondary side.
10. Rise Time: The interval for the gate voltage to increase from 10% of its off-state level to 90% of its on-state level.
11. Fall Time: The time required for the gate voltage to fall from 90% of the turn-on voltage to 10% of the turn-off voltage.
12. After a fault condition clears, the driver resets following the fault blanking time. The typical value is set to 80 ms. The value indicated in the datasheet corresponds to actual measurements obtained under laboratory conditions.
13. The SOx output signal is high under normal operation. When a fault occurs, the signal goes low. Fault type can be determined by the low-level duration: 10 ms for short-circuit, 20 ms for secondary undervoltage, and 40 ms for primary undervoltage.
14. Creepage and clearance distances are designed according to IEC 61800-5-1:2007, meeting basic insulation requirements for altitudes below 2 km, PD 2, and overvoltage category II.
15. The driver power supply has passed partial discharge testing in accordance with IEC 60270. The test was performed at a peak voltage of 1800 V.

Mechanical Dimensions







Note: 1. The thickness tolerance of the board is ±10%;

2. Other dimensional tolerances refer to GB/T1804-m.

Update Information

Date	Description	Version
2025.09.11	Sample Datasheet	V0.1
2026.04.01	1. Part number update 2. Product picture	V1.0

Ordering Information

2FHD0225 can support different part number of modules from multiple manufacturers. When purchasing, please add the module part number after the driver model number so that we can provide the driver that best meets your needs.

Part Number	Gate Voltage (V)	R_{GON}（Ω）	R_{GOFF}（Ω）	Coating	Module
2FHD0225C17A22-S0000	18/-4	3.3	3.3	No	SiC
2FHD0225C17A22-S0001	18/-4	NC	NC	No	SiC
2FHD0225C17A22C-S0000	18/-4	3.3	3.3	Yes	SiC
2FHD0225C17A20-S0000	15/-5	3.3	3.3	No	SiC
2FHD0225C17A20-S0001	15/-5	NC	NC	No	SiC
2FHD0225C17A20C-S0000	15/-5	3.3	3.3	Yes	SiC
2FHD0225C17A20-Y0001	15/-5	NC	NC	No	IGBT

Technical Support

Firstack's professional team will provide you with business consultation, technical support, product selection, price, lead time and other related information, and guarantee to answer your questions within 48 hours.

Legal Disclaimer

The instruction manual provides a detailed description of the product but does not commit to providing specific parameters regarding the delivery, performance, or applicability of the product. This document does not offer any express or implied warranties or guarantees.

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