2FHC06M33XX Data Sheet

Abstract

The 2FHC06M33XX is a high-performance, dual-channel SiC gate driver core developed based on Firstack intelligent chip technology, supports SiC modules up to 3300V. The overall architecture consists of a MCC (main control core) and multiple MAB (module adaptor board) units, the MCC and MAB are connected by a set of cables, which can flexibly match 1~4 SiC modules. The 2FHC06M33XX integrates driver protection, intelligent fault management, distributed NTC sampling and other functions, and is suitable for multi- parallel connection of packages such as Infineon XHP_2, Mitsubishi LV100, Hitachi Linpak and so on. The 2FHC06M33XX is mainly used in PV, wind, rail and other high reliability fields.

Highlights:

● Support up to 4 in parallel

● Support SiC modules up to 3300V

● Distributed NTC sampling

● Short-circuit protection (soft shut down)

● Miller clamping

● Intelligent fault management

● UVLO
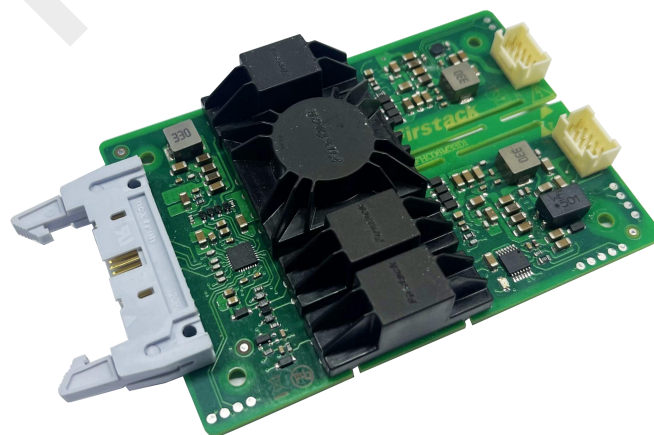
Applications:

● PV

● Wind

● Rail

Fig.1　2FHC06M33XX
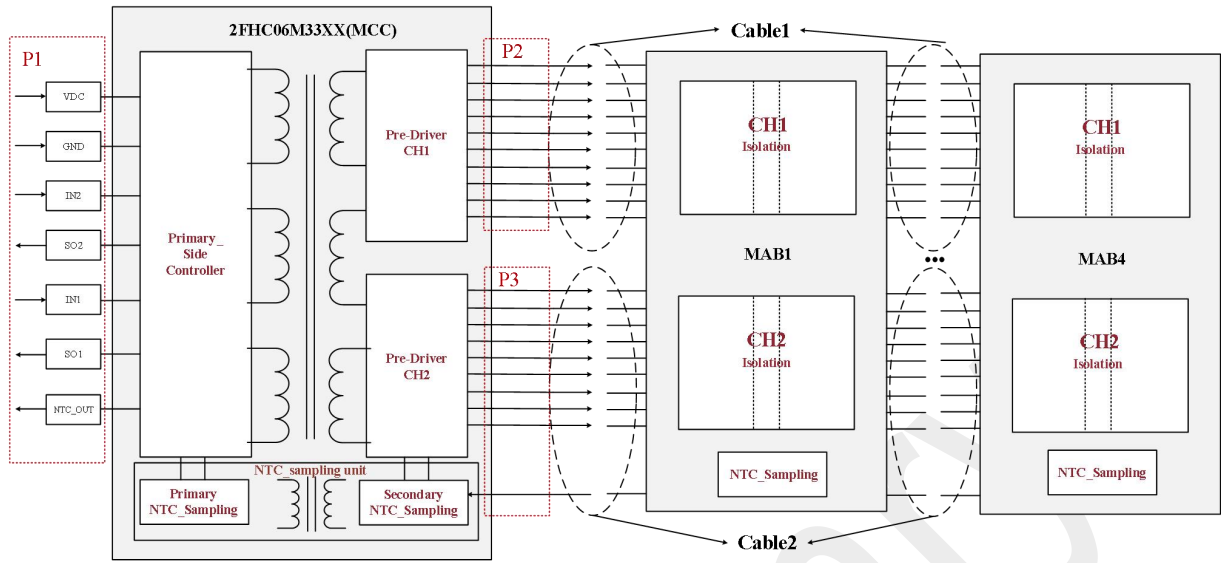
Functional Block Diagram

Fig.2   Functional block diagram
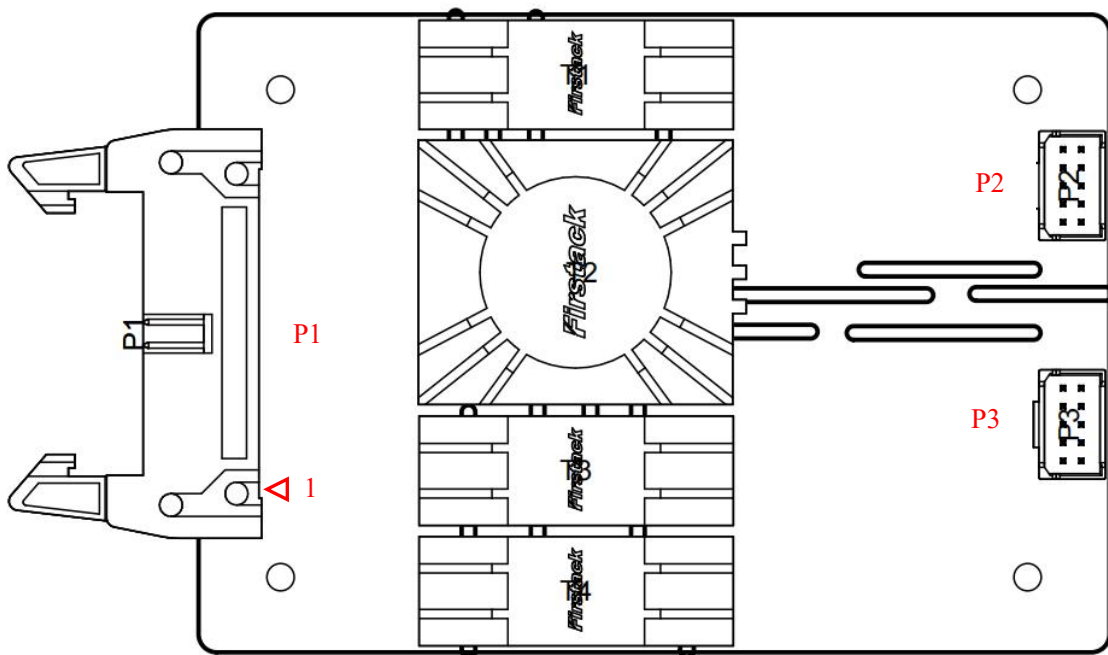
Connector Interface Designation

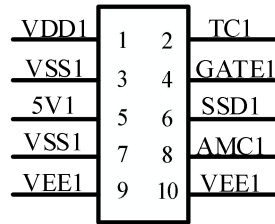**Fig.3**   Connector Interface location
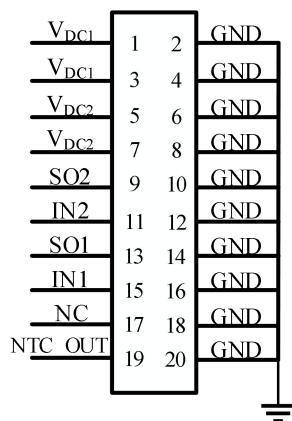
P1 terminal pin designation

Pin	Definition	Function	Pin	Definition	Function
1	V_{DC1}	24V input	2	GND	Primary side ground
3	V_{DC1}	24V input	4	GND	Primary side ground
5	V_{DC2}	15V input	6	GND	Primary side ground
7	V_{DC2}	15V input	8	GND	Primary side ground
9	SO2	Status output channel 2	10	GND	Primary side ground
11	IN2	Signal input channel 2	12	GND	Primary side ground
13	SO1	Status output channel 1	14	GND	Primary side ground
15	IN1	Signal input channel 1	16	GND	Primary side ground
17	NC	Free	18	GND	Primary side ground
19	NTC_OUT	NTC signal output	20	GND	Primary side ground

```
VDD1 ┌───┬───┐ TC1
      │ 1 │ 2 │
VSS1 ─┤   │   ├─ GATE1
      │ 3 │ 4 │
5V1  ─┤   │   ├─ SSD1
      │ 5 │ 6 │
VSS1 ─┤   │   ├─ AMC1
      │ 7 │ 8 │
VEE1 ─┤ 9 │10 ├─ VEE1
      └───┴───┘
```

P2 terminal pin designation

Pin	Definition	Function	Pin	Definition	Function
1	VDD1	Secondary side positive supply channel 1	2	TC1	Secondary side short-circuit detection signal channel 1
3	VSS1	Secondary side negative supply channel 1	4	GATE1	Gate drive signal channel 1
5	5V1	Secondary side 5V supply channel 1	6	SSD1	Soft shut down signal channel 1
7	VSS1	Secondary side negative supply channel 1	8	AMC1	Miller clamping signal channel 1
9	VEE1	Secondary side ground channel 1	10	VEE1	Secondary side ground channel 1

```
VDD2  ┌───┬───┐ TC2
       │ 1 │ 2 │
VSS2  ─┤   │   ├─ GATE2
       │ 3 │ 4 │
5V2   ─┤   │   ├─ SSD2
       │ 5 │ 6 │
5V_NTC─┤   │   ├─ AMC2
       │ 7 │ 8 │
NTC_IN─┤ 9 │10 ├─ VEE2
       └───┴───┘
```
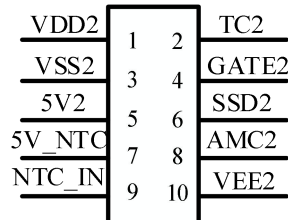
P3 terminal pin designation

Pin	Definition	Function	Pin	Definition	Function
1	VDD2	Secondary side positive supply channel 2	2	TC2	Secondary side short-circuit detection signal channel 2
3	VSS2	Secondary side negative supply channel 2	4	GATE2	Gate drive signal channel 2
5	5V2	Secondary side 5V supply channel 2	6	SSD2	Soft shut down signal channel 2
7	5V_NTC	Secondary side NTC sampling channel 2	8	AMC2	Miller clamping signal channel 2
9	NTC_IN	NTC sampling input	10	VEE2	Secondary side ground channel 2

3D and Mechanical Dimensions

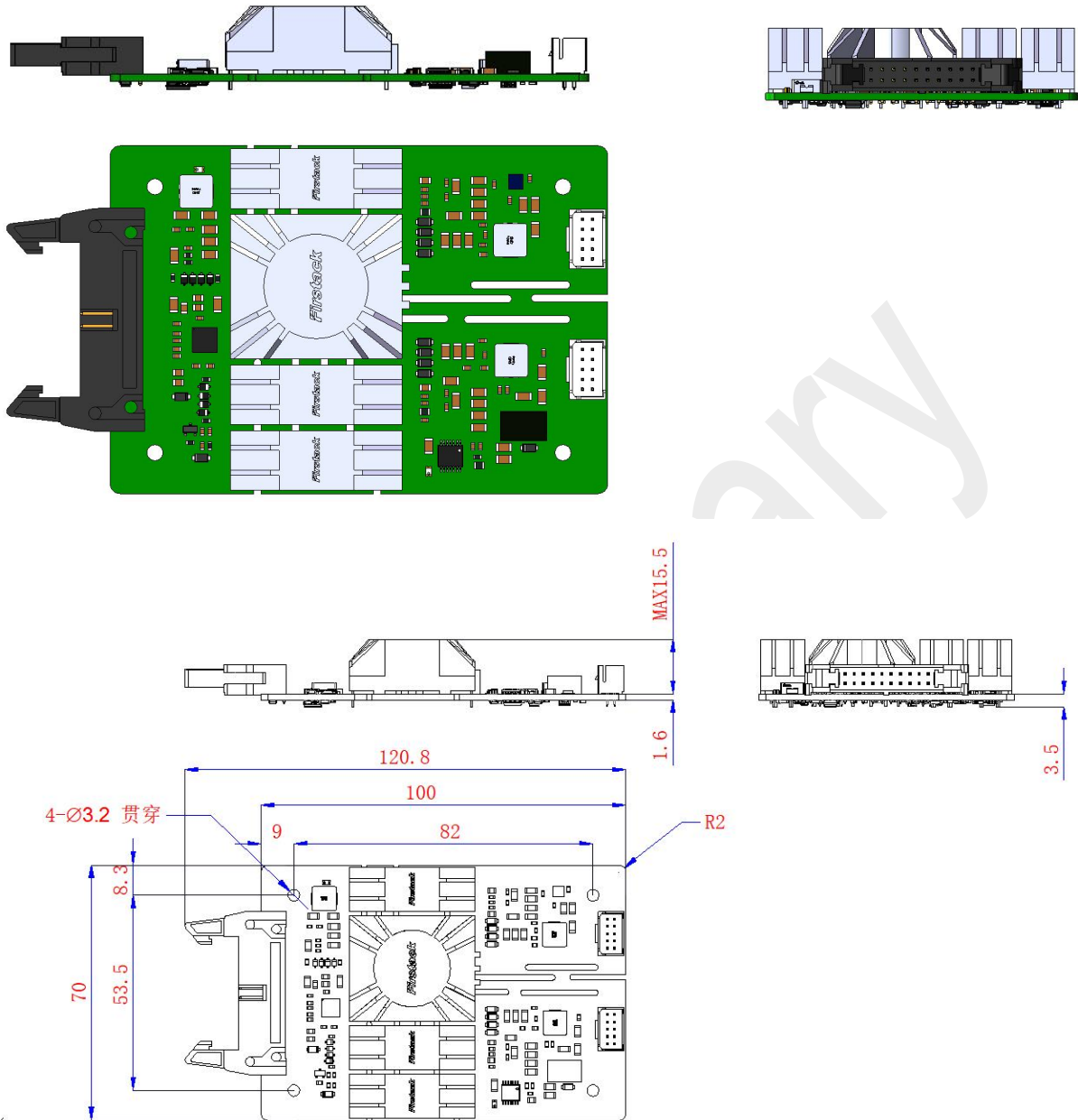**Fig.4** 3D and mechanical dimensions (unit: mm)

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

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

3. As individual driver core board, if Firstack does not perform coating/coating adhesive, it is necessary to coat including the 20 exposed pins of the transformer when coating the overall driver surface.

Technical Parameters

Absolute Maximum Ratings

Parameter	Remarks	Min	Typ	Max	Unit
Supply voltage V_{DC}	V_{DC} to GND, Note 1	14	15	16	V
	V_{DC} to GND, Note 1	23	24	25	V
Supply current I_{DC}	Without load		0.13		A
Coupling capacitance C_{IO}	Primary to secondary side		TBD		pF
Supply undervoltage threshold	Primary side		12		V
Output power	Per channel		6		W
Operating temperature		-40		85	°C
Storage temperature		-40		85	°C

Gate Drive Parameters

Output voltage	Remarks	Min	Typ	Max	Unit
Total gate voltage	V_{GSon} - V_{GSoff}	20.5	22	24.5	V
Gate positive voltage V_{GSon}	Turn on (ON)	14.5	18	19.5	V
Gate negative voltage V_{GSoff}	Turn off (OFF)	-9.5	-4	-0.5	V

Logic Inputs & Outputs

Parameter	Remarks	Min	Typ	Max	Unit
Input signal INx	INx to GND	14.5	15	15.5	V
Input impedance			100		kΩ
Turn-on threshold	V(INx)	9.2			V
Turn-off threshold	V(INx)			3.2	V
Fault output SOx	Io<10mA			0.35	V

NTC Sampling

Parameter	Remarks	Duty cycle for temperature output	Unit
Temperature output	Fixed frequency 4K, variable duty cycle, output the highest temperature	Note 2	μs

Short-Circuit Protection

Parameter	Remarks	Min	Typ	Max	Unit
V$_{DS}$ monitoring threshold	Short-circuit protection threshold	Configurable	11	Configurable	V
Response time	Note 3	Configurable	2	Configurable	μs
Soft shut down time		Configurable	6.24	Configurable	μs

Miller Clamping

Parameter	Remarks	Min	Typ	Max	Unit
Time from drive signal turn-off to clamp turn-on		Configurable	1.56	Configurable	μs
Time from clamp turn-off to drive signal turn-on			500		ns
Clamp voltage			VSS (negative voltage)		

Timing Characteristics

Parameter	Remarks	Min	Typ	Max	Unit
Turn-on delay	Note 4		1.2		μs
Turn-off delay	Note 5		1.3		μs
Rise time	Note 6		15		ns
Fall time	Note 7		15		ns
Fault blocking time			80		ms
Fault return time	Note 8		10		ms

Electrical Isolation

Parameter	Remarks	Min	Typ	Max	Unit
Creepage distance	Primary to secondary side, Note 9		32		mm
	Secondary to secondary side, Note 9		25		mm
Clearance distance	Primary to secondary side		30		mm
	Secondary to secondary side		14		mm

Unless otherwise specified, all data are based on tests at +25℃ ambient temperature and V_{DC}=15/24V.

Note:

1. Supply voltage: 15V or 24V input only one power supply is required;

2. Temperature output duty cycle: (refer to Infineon NTC)

Temperature(℃)	Rntc(kΩ)	Duty Cycle (%)
-40	99.092	6.0%
-35	75.144	8.0%
-30	57.533	10.0%
-25	44.448	12.0%
-20	34.610	14.0%
-15	27.156	16.0%
-10	21.483	18.0%
-5	17.120	20.0%
0	13.727	22.0%
5	11.082	24.0%
10	9.003	26.0%
15	7.359	28.0%
20	6.049	30.0%
25	5.000	32.0%
30	4.156	34.0%

35	3.472	36.0%
40	2.914	38.0%
45	2.458	40.0%
50	2.083	42.0%
55	1.773	44.0%
60	1.515	46.0%
65	1.300	48.0%
70	1.120	50.0%
75	0.968	52.0%
80	0.840	54.0%
85	0.732	56.0%
90	0.640	58.0%
95	0.561	60.0%
100	0.493	62.0%
105	0.435	64.0%
110	0.385	66.0%
115	0.342	68.0%
120	0.304	70.0%
125	0.271	72.0%
130	0.243	74.0%
135	0.217	76.0%
140	0.195	78.0%
145	0.176	80.0%
150	0.158	82.0%

3. Response time: the time from the occurrence of the fault to the start of soft shut down;

4. Turn-on delay: the time required to transmit from the rising edge of the PWM signal from the primary input to the rising edge of the secondary of the gate driver;

5. Turn-off delay: the time required to transmit from the falling edge of the PWM signal from the primary input to the falling edge of the secondary side of the gate driver;

6. Rise time: the amount of time from 10% of the gate turn-off voltage (-4V) to 90% of the gate turn-on voltage (+18V);

7. Fall time: the amount of time from 90% of the gate turn-on voltage (+18V) to 10% of the gate turn-off voltage (-4V);

8. Fault return time: 10ms for short circuit fault, 20ms for secondary side undervoltage fault, 40ms for primary side undervoltage fault;

9. Creepage distance: refer to IEC61800-5-1-2007, meet the basic isolation requirements for altitudes below 2km and pollution level 2; this value takes the creepage distance of the isolation device.

Ordering Information

The 2FHC06M33XX supports different part numbers of modules from multiple manufacturers. If you have a purchase request, please add the module part number after the gate driver part number, and we can provide the gate driver that best meets your requirements.

Part number	Input voltage	Output positive voltage	Output negative voltage
2FHC06M33D2-151804	15V	18V	-4V
2FHC06M33D2-151507	15V	15V	-7V

Technical Support

Firstack's professional team will provide you with business consultation and technical support. Please contact the Firstack technical sales team if you require the application manual for further information of the technical application.

Legal Disclaimer

This manual gives a detailed introduction about the product, but cannot promise to provide specific parameters. No warranty or guarantee, express or implied, is given herein as to the delivery, performance or applicability of the product.

Firstack reserves the right to modify technical data and product specifications at any time without prior notice. Firstack's general payment terms and conditions apply.

Contact Information

Tel: +86-571 8817 2737

Fax: +86-571 8817 3973

Website: www.firstack.com

Email: fsales@firstack.com

Address: 4-5/F, Building/5, Xizi Wisdom Industrial Park, No.1279 Tongxie Road, Hangzhou, China