

## 2FHC06M33XX Data Sheet

### Abstract

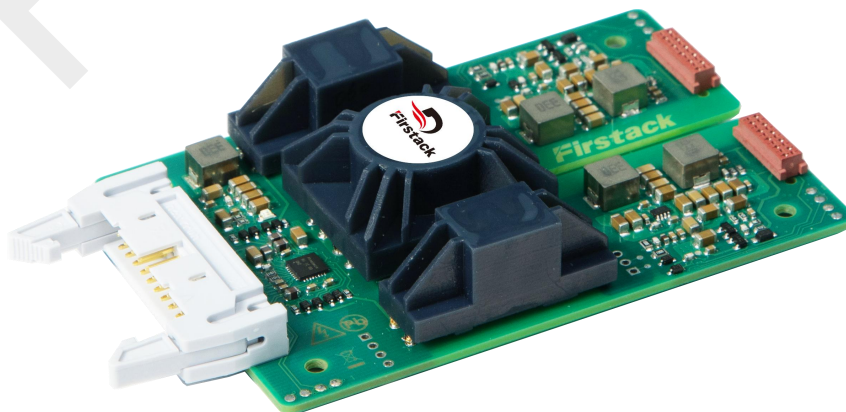
The 2FHC06M33XX is a high-performance, dual-channel SiC/IGBT gate driver core developed based on Firstack intelligent chip technology, which supports SiC modules up to 3300V. The overall architecture consists of a MCC (main control core) and multiple MAB (module adaptor board) units, the MCC and MAB are connected by a set of cables. The 2FHC06M33XX can flexibly match 1~4 SiC/IGBT modules, 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 fields.

### Highlights:

- Support up to 4 in parallel
- Support for SiC/IGBT modules up to 3300V
- Short-circuit protection (soft shut down)
- Digital control method
- Miller clamp
- Intelligent fault feedback
- Undervoltage protection

### Applications:

- PV
- Wind
- Rail

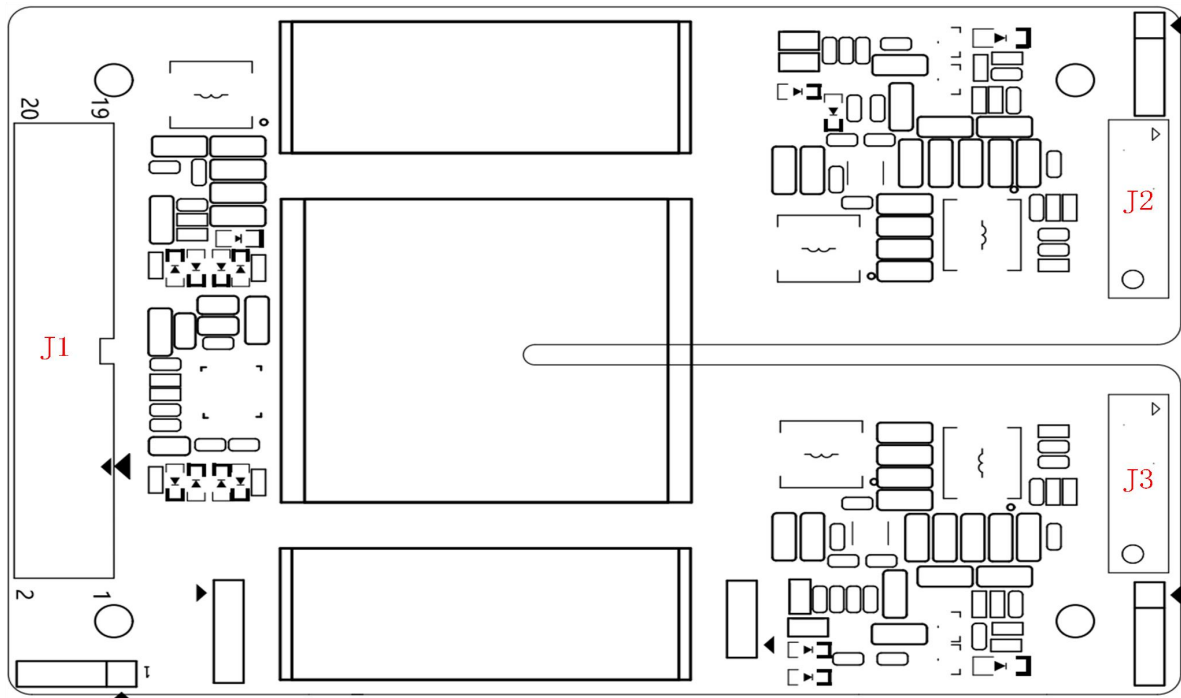


**Fig.1** 2FHC06M33XX

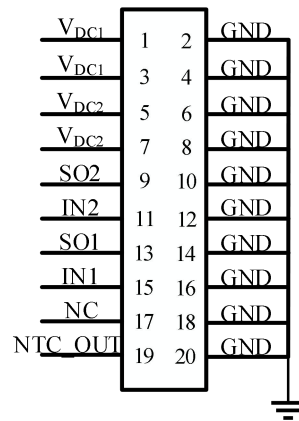
The diagram illustrates the system architecture, starting with a 2FHC06M33XX(MCC) module. This module is connected to a Primary Side Controller, which in turn is connected to a Pre-Driver Channel 1 and a Pre-Driver Channel 2. The Primary Side Controller is connected to VCC, GND, IN2, SO2, IN1, SO1, and NTC\_OUT. The Pre-Driver Channel 1 is connected to VDD1, VEE1, VSS1, GATE1, TC1, AMC1, SC1, and +5V1. The Pre-Driver Channel 2 is connected to VDD2, VEE2, VSS2, GATE2, TC2, AMC2, SC2, and +5V2. The NTC sample unit consists of a Primary NTC\_Sample and a Secondary NTC\_Sample. The system is connected to Cable1 and Cable2 via Channel2 Isolation and Channel1 Isolation blocks, which are connected to MAB blocks.

**Fig.2** Functional block diagram

## Connector Interface Designation

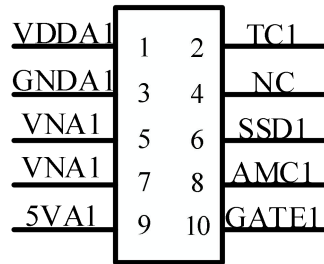


**Fig.3** Interface definition diagram



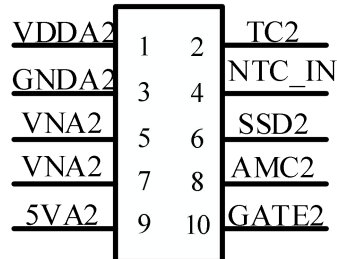
### J1 terminal pin designation

Pin	Definition	Function	Pin	Definition	Function
1	V <sub>DC1</sub>	24V input	2	GND	Primary side ground
3	V <sub>DC1</sub>	24V input	4	GND	Primary side ground
5	V <sub>DC2</sub>	15V input	6	GND	Primary side ground
7	V <sub>DC2</sub>	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	Free	20	GND	Primary side ground



## J2 terminal pin definition

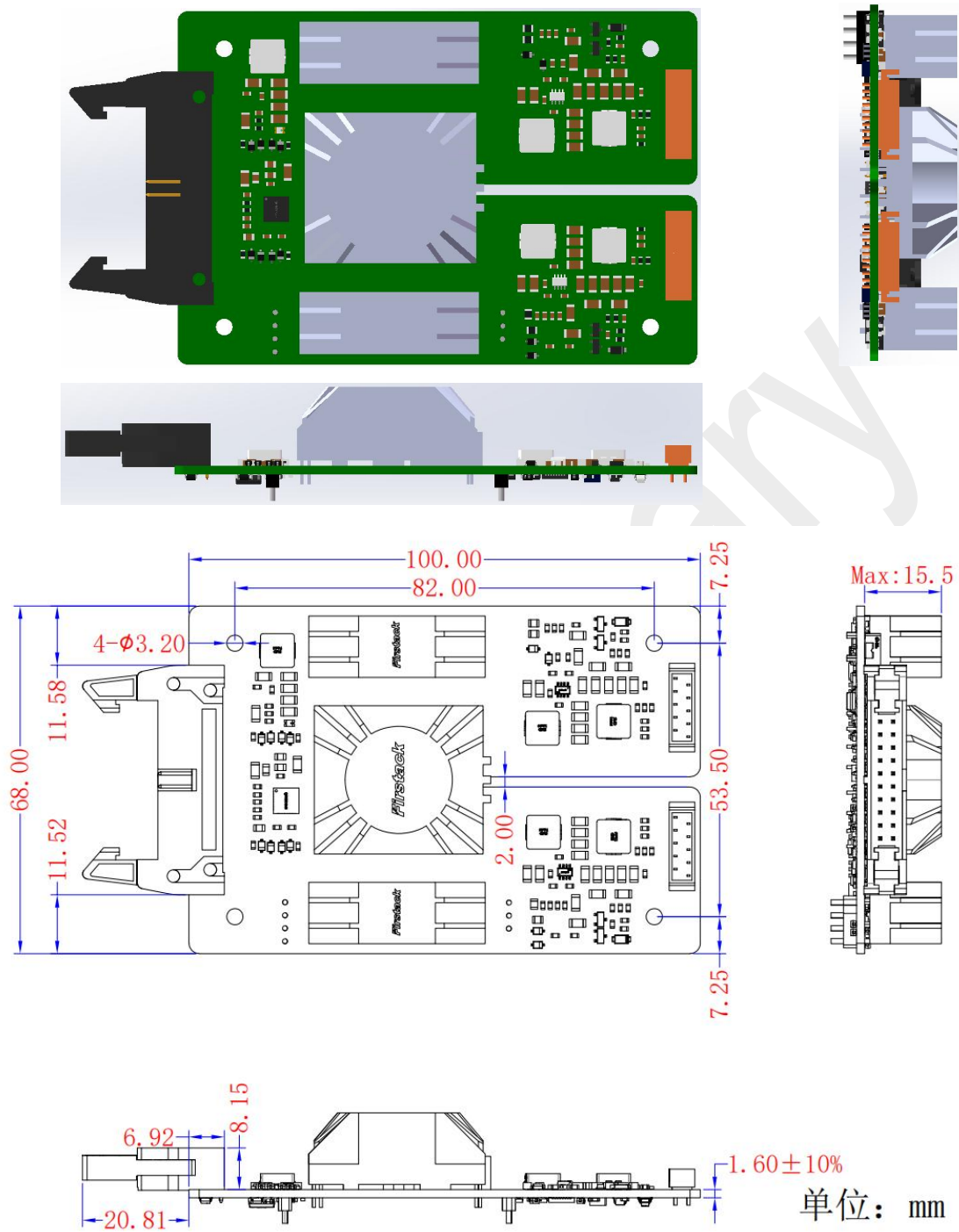
Pin	Definition	Function	Pin	Definition	Function
1	VDDA1	Secondary side positive supply channel 1	2	TC1	Secondary side short-circuit detection signal channel 1
3	GNDA1	Secondary side ground	4	NC	Free
5	VNA1	Secondary side negative supply channel 1	6	SSD1	Soft shut down signal channel 1
7	VNA1	Secondary side negative supply channel 1	8	AMC1	Miller clamp signal channel 1
9	5VA1	Secondary side 5V supply channel 1	10	GATE1	Gate drive signal channel 1



## J3 terminal pin definition

Pin	Definition	Function	Pin	Definition	Function
1	VDDA2	Secondary side positive supply channel 2	2	TC2	Secondary side short-circuit detection signal channel 2
3	GNDA2	Secondary side ground channel 2	4	NC	Free
5	VNA2	Secondary side negative supply channel 2	6	SSD2	Soft shut down signal channel 2
7	VNA2	Secondary side negative supply channel 2	8	AMC2	Miller clamp signal channel 2
9	5VA2	Secondary side 5V supply channel 2	10	GATE2	Gate drive signal channel 2

## 3D and Mechanical Dimensions



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

Note: 1.The thickness tolerance of the board is  $\pm 10\%$ ;

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

3. Individual driver core board, if Firstack does not perform spraying coat, it is necessary to coat including the 9 exposed pins of the transformer when coating the overall driver surface.

## Technical Parameters

### Recommended Operating Conditions

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	18	24	26	V
Supply current $I_{DC}$	Without load		TBD		A
Coupling capacitance $C_{IO}$	Primary to secondary side		TBD		pF
Supply undervoltage threshold	Primary side		12		V
Output power per channel			6		W

### Gate driver parameters

Output level	Remarks	Min	Typ	Max	Unit
Gate voltage	$V_{GSon}-V_{GSoff}$	19.5	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 $IN_x$	$IN_x$ to GND	14.5	15	15.5	V
Input impedance			100		k $\Omega$
Turn-on threshold	$V(IN_x)$	9.2			V
Turn-off threshold	$V(IN_x)$			3.2	V
Fault output $SO_x$	$I_o < 10mA$			0.35	V

## NTC sampling

Parameter	Remarks	Temperature output corresponding frequency	Unit
Temperature output frequency	Frequency conversion sampling, take the highest temperature and upload, Note 2	$F_{out}=0.1*f_{CLKIN}+0.8*(V_{IN}/V_{REF})*f_{CLKIN}$ $V_{IN}=V_{CC}*R_2/(R_2+1.5k\Omega)$	Hz

## Short-Circuit Protection

Parameter	Remarks	Min	Typ	Max	Unit
V <sub>DS</sub> monitoring threshold	Short-circuit protection threshold	Configurable	11	Configurable	V
Response time	Note 3	Configurable	1.2	Configurable	μs
Soft shut down time		Configurable	6.24	Configurable	μs

## Miller Clamp

Parameter	Remarks	Min	Typ	Max	Unit
Time from driving signal turn- off to clamp turn-on		Configurable	500	Configurable	ns
Time from Miller clamp turn- off to driving signal turn-on			500		ns
Clamp voltage			V <sub>N</sub> negative		

## 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		50		ns
Fall time	Note 7		50		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		29		mm
	Secondary to secondary side, Note 9		25		mm
Clearance distance	Primary to secondary side		25		mm
	Secondary to secondary side		14		mm

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

Note:

1. Supply voltage: 15V or 24V input only one power supply is required;
2. Temperature output frequency:  $f_{CLKIN}=32.768kHz$ ;  $R_2=R_{NTC}/10k\Omega$ ;  $V_{CC}=5V$ ;  $V_{REF}=5V$ ;
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
2FHC06M33C1	15V	18V	-4V

## 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](http://www.firstack.com)

Email: [fsales@firstack.com](mailto:fsales@firstack.com)

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