2FHD0115C Data Sheet

Abstract

The 2FHD0115C is a high performance, dual-channel plug-and-play gate driver developed by Firstack based on intelligent chip technology. It is designed for EconoDual™ package and supports IGBT modules up to 1700V. Plug-and-play, and can drive IGBT modules safely and reliably without other peripheral circuits.

Highlights:

- 1.2W/20A, support up to 50kHz applications
- Suitable for 1700V module
- Short-circuit protection(soft shut down)
- Digital control
- Supports multi-level applications

Applications:

- Motor drives
- ESS

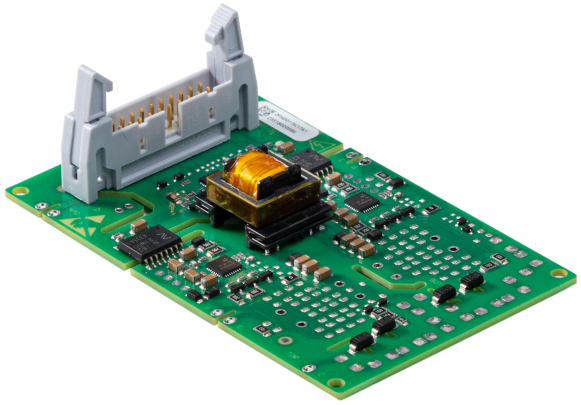


Fig.1 2FHD0115C

Functional Block Diagram

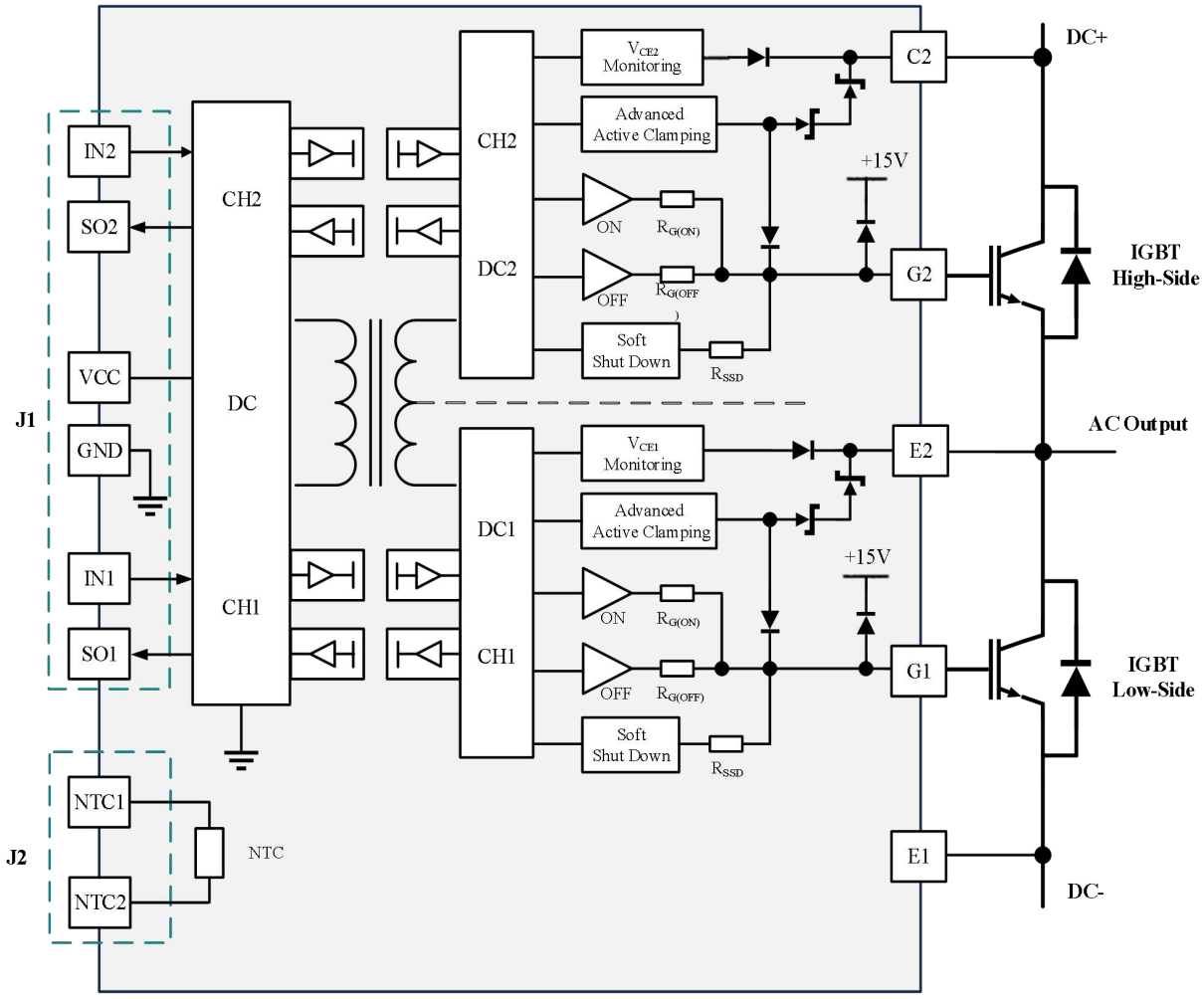
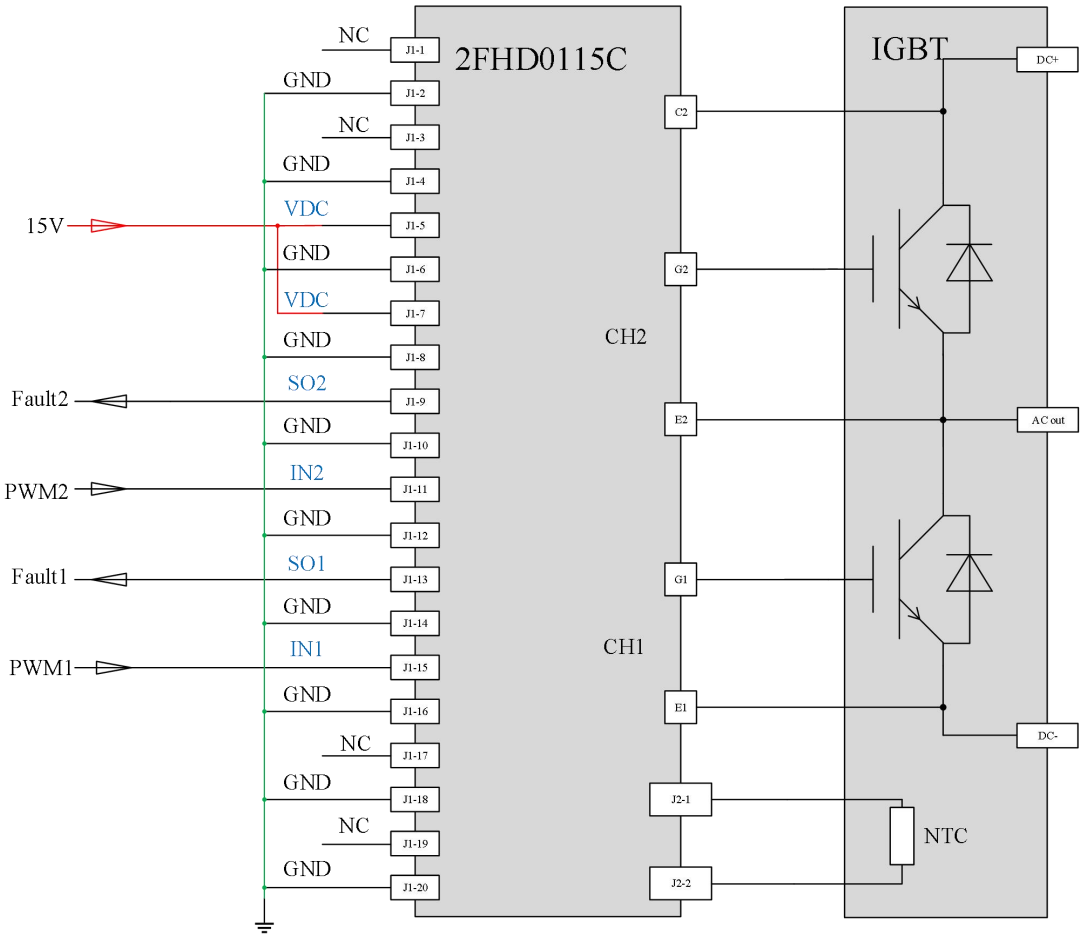


Fig.2 Functional block diagram

Connector J1 Recommended Interface Circuitry



J1 terminal pin definition

Pin	Definition	Function	Pin	Definition	Function
1	NC	Free	2	GND	Primary side ground
3	NC	Free	4	GND	Primary side ground
5	V_{DC}	Power supply input	6	GND	Primary side ground
7	V_{DC}	Power supply 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	NC	Free	20	GND	Primary side ground

Technical Parameters

Absolute Maximum Ratings

Parameter	Remarks	Min	Max	Unit
Power supply V_{DC}	V_{DC} to GND	0	15.5	V
Logic input and output voltages	Primary side, to GND	0	V_{DC}+0.5V	V
Output power per channel	@85℃		1.2	W
Gate peak current	@85℃	-20	20	A
Test voltage(50Hz/1min)	Primary to secondary side	5000		V_{RMS}
DC bus voltage	2FHD0115C12		800	V
	2FHD0115C17		1200	V
Operating temperature		-40	85	℃
Storage temperature		-40	90	℃

Recommended Operating Conditions

Parameter	Remarks	Min	Typ	Max	Unit
Supply voltage V_{DC}	V_{DC} to GND	14.5	15	15.5	V
Power supply current I_{DC}	Without load		0.11		A
Coupling capacitance C_{IO}	Primary to secondary side		20		pF
Undervoltage threshold	Power supply		12		V

Gate Driving Parameters

Output level, Note1	Remarks	Min	Typ	Max	Unit
Gate voltage V_{GE}	Turn on (ON)	14.5	15	15.5	V
Gate voltage V_{GE}	Turn off (OFF)	-9.5	-8.5	-7.5	V

Logic Input and Output Voltages

Parameter	Remarks	Min	Typ	Max	Unit
Input signal INx	Reference ground	4.5	15	15.5	V
Input impedance			10		kΩ
Turn-on threshold	V(INx) - 5V		2.6		V
	V(INx) - 15V		7.4		
Turn-off threshold	V(INx) - 5V		1.6		V
	V(INx) - 15V		4.8		
Fault output SOx	Protection state @Io<10mA			0.35	V
MOD mode	Direct mode	Set by software, no configuration required			
	Half-bridge mode	Set by software, no configuration required			

Short-circuit Protection

Parameter	Remarks	Min	Typ	Max	Unit
V_{CE} monitoring threshold	Short-circuit protection monitoring threshold		11		V
Response time	CH1, Note 2		8		us
	CH2, Note 2		8		us
Soft shut down time	Soft shut down action time		4.16		us

Timing Characteristics

Parameter	Remarks	Min	Typ	Max	Unit
Turn-on delay	Note 3		700		ns
Turn-off delay	Note 4		700		ns
Rise time	Note 5		15		ns
Fall time	Note 6		15		ns

Fault block time	80	ms
Fault return time	10	ms

Electrical Isolation

Parameter	Remarks	Min	Typ	Max	Unit
Creepage distance	Primary to secondary side, Note 7	8			mm
	Secondary to secondary side	6.5			mm
Clearance distance	Primary to secondary side	8			mm
	Secondary to secondary side	5			mm

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

Notes:

1. Gate voltage: the range of actual measured gate voltage;
2. Response time: the time from the occurrence of the fault to the start of soft shut down;
3. Turn-on delay: the time required to transmit from the rising edge of the PWM signal from the primary input to the to the rising edge of the secondary side of the gate driver;
4. 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;
5. Rise time: the amount of time from 10% of the gate turn-off voltage(-8.5V) to 90% of the gate turn-on voltage(+15V);
6. Fall Time: the amount of time from 90% of the gate turn-on voltage(+15V) to 10% of the gate turn-off voltage(-8.5V);
7. Fault return time: the fault hold time under SC fault;
8. Creepage distance: refer to IEC61800-5-1-2007, meet the basic isolation requirements of pollution level 2 at an altitude of less than 2km elevation; the value is taken as the creepage distance of the isolation device.

Gate Resistor and Capacitor Indication

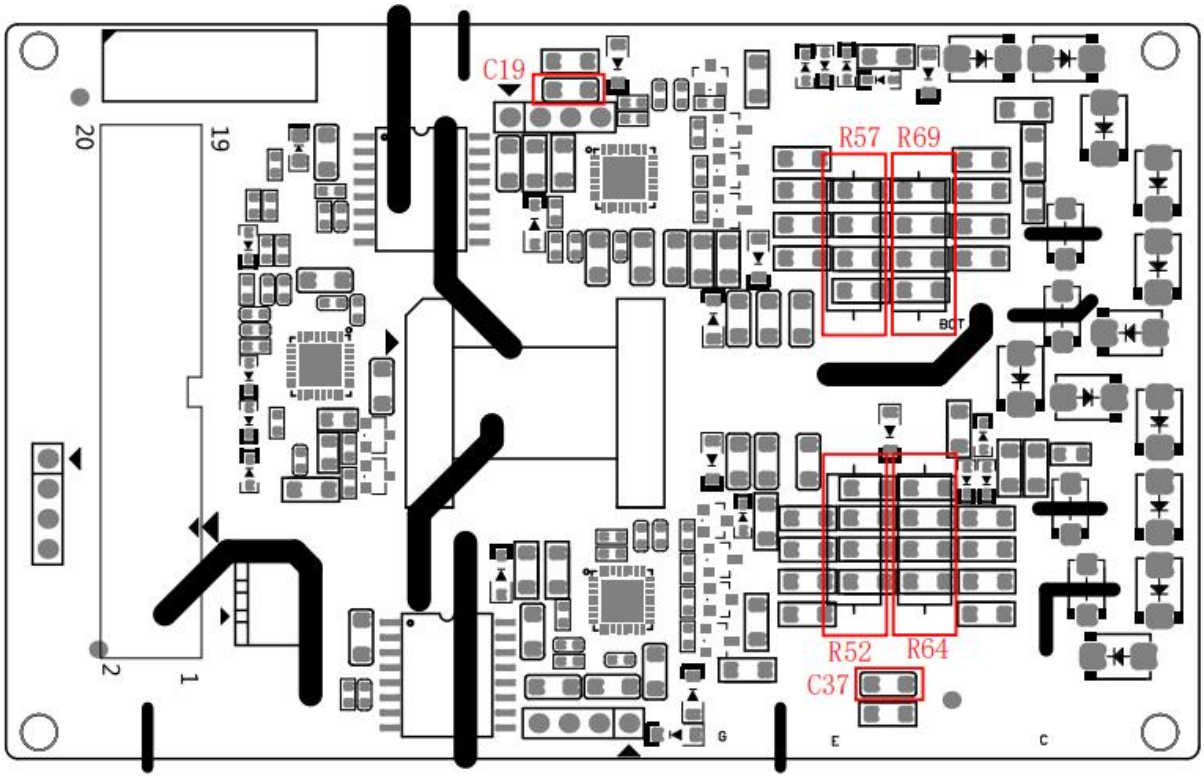


Fig.3 Gate resistor and capacitor position indication

Gate Resistor and capacitor calculation formula

Parameter	R_{GON}	R_{GOFF}	C_{GE}
CH1	R57	R69	C19
CH2	R52	R64	C37

Recommended resistors

Option	Power	Manufacturer	Package	Individual resistor power	Dimensions
1	<1W	YAGEO	1206 patch	1/4W	Length × width: 3.2mm × 1.6mm
2	<1W	TY-OHM ELECTRONIC	Plug	2W	Diameter × length: 4.5mm × 11mm
3	<1W	Double Circle	Plug	2W	Diameter × length: 4.5mm × 11mm
3	1W<P<2W	TY-OHM ELECTRONIC	Plug	3W	Diameter × length: 5.0mm × 15mm

Note: For product models in the 2FHD0115C series featuring gate resistors, the default factory configuration is through-hole resistors. Unless otherwise specified, resistors are typically supplied by either TY-OHM or Double Circle. Due to factors such as original manufacturer lead times, shipments may contain a mix of both brands (Double Circle resistors are blue, TY-OHM are gray). Actual delivery may vary; please refer to the physical items received.

Gate resistance of commonly used modules

IGBT part number	R_{GON} (Ω)	R_{GOFF} (Ω)	C_{GE}(nF)
FF900R12ME7	1.2	1.8	/
FF600R17ME4	1.2	1.8	/
FF600R12ME7	1.2	1.8	/
FF450R12ME7	1.2	1.8	/
FF300R12ME7	1.2	1.8	/
2MBI600XNG170-50	1.2	1.8	/
2MBI600VN-170P-50	1.2	1.8	/
2MBI600VX-120-50	1.2	1.8	/
2MBI450VN-120-50	1.2	1.8	/
2MBI450VN-170-50	3.3	4.3	/
DIM600M1HS17-PA500	1.2	1.8	/
DIM450M1HS17-PA500	3.3	4.3	/
TG600HF17M1-S300	1.2	1.8	/
TG450HF17M1-S3A00	4.3	6.2	/
TG450HF12M1-S300	3.3	4.3	/
SEMiX603GB17E4p	1.2	1.8	/
SEMiX453GB17E4p	3.3	4.3	/

3D and Mechanical Dimensions

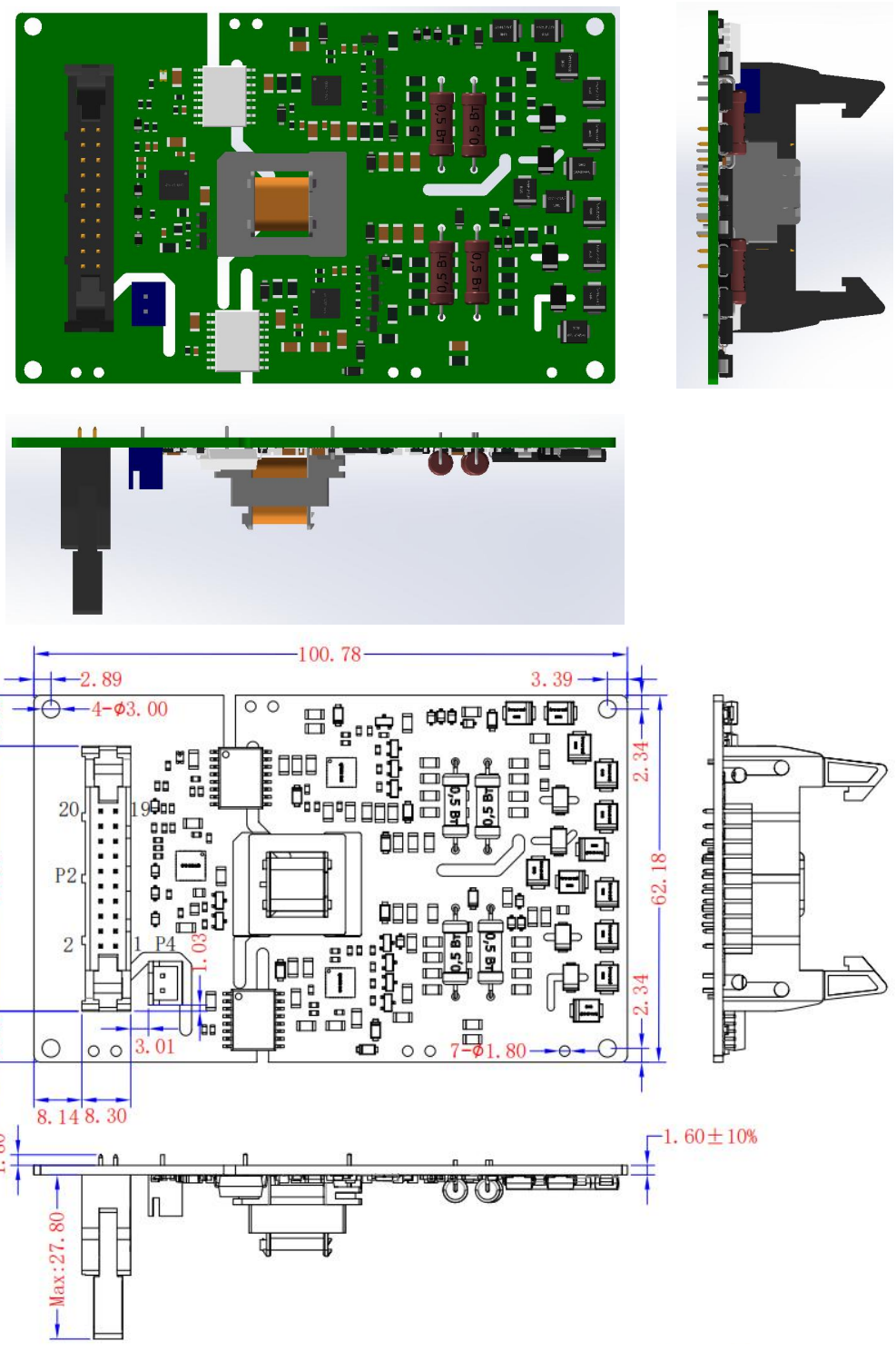


Fig.4 3D and mechanical dimensions(unit: mm)

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

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

3.NTC terminal (J2) is not welded by default, please contact sales for customization if required.

Ref	Description	Manufacturer	Part number	Recommended terminal	Harness
J1	20Pin ejector header	Nextron	Z-230010820209	Z-81020100124000	3M 2100/20
J2	NTC terminal	JST	(G)B2B-XH-A(LF)(SN)(P)	XHP-2	

Ordering Information

2FHD0115C can support EconoDual™ package modules from multiple manufacturers with different part numbers. If the products in the table below can not meet your needs, please contact Firstack sales department for customization.

Part Number	Operating Mode	PWM Threshold	SOx	Note[1]
2FHD0115C17A1	Direct	5V~15V	OD	NC, lead free
2FHD0115C17B1	Direct	15V	15V	NC, lead free
2FHD0115C17D1	Half-bridge	5V~15V	OD	NC, lead free
2FHD0115C17A1C-S11	Direct	5V~15V	OD	Rgon=1.25, Rgoff=1.875, C_{GE}=NC, lead free
2FHD0115C17A1C-S12	Direct	5V~15V	OD	Rgon=3.5, Rgoff=4.1, C_{GE}=NC, lead free
2FHD0115C17A1C-S13	Direct	5V~15V	OD	Rgon=2.5, Rgoff=4.9, C_{GE}=47nF, lead free
2FHD0115C17A1C-Y0401	Direct	5V~15V	OD	Rgon=1.5, Rgoff=2.4, C_{GE}=NC, lead free
2FHD0115C17B1C-Y0401	Direct	15V	15V	Rgon=1.5, Rgoff=2.4, C_{GE}=NC, lead free
2FHD0115C12C1	Direct	5V~15V	OD	1200V with TVS, NC, lead free
2FHD0115C17C1	Direct	5V~15V	OD	1700V with TVS, NC, lead free
2FHD0115C12F1	Direct	15V	15V	1200V with TVS, NC, lead free
2FHD0115C17F1	Direct	15V	15V	1700V with TVS, NC, lead free
2FHD0115C17G1	Interlock	5V~15V	15V	NC, lead free

1.Only NC means that there is no TVS, Cge, Rgon and Rgoff. With TVS but NC means there is no Rgon, Rgoff and Cge.

Technical Support

Firstack's professional team will provide you with business consultation and technical support. For further information on technical applications, please contact Firstack technical sales team to provide you with application manuals.

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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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