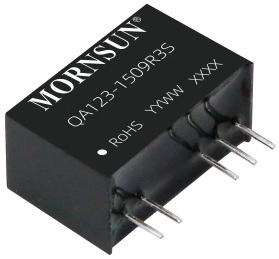
DC/DC Converter for IGBT Driver

QAxx3-R3S Series

MORNSUN®

IGBT driver power supply



RoHS

FEATURES

- Reinforced insulation
- I/O isolation test voltage: 5000VAC
- Continuous barrier withstand voltage 1700V
- Characterised CMTI>200kV/μs
- Max. Capacitive Load: 2200μF
- Ultra-low isolation capacitance: 3.5pF (typ.)
- High efficiency up to 87%
- SIP package
- Operating ambient temperature range: -40℃ to +105℃
- Continuous short-circuit protection

QAxx3-R3S is DC-DC module power supplie designed for IGBT driver requiring two sets of isolation power supply. The mode of common ground outputs is adopted internally for better energy provision of IGBT turn-on and turn-off. Output short-circuit protection and self-recovery capabilities are also provided. General application includes:

1. Universal converter

2. AC servo drive system

3. Electric welding machine

4. Uninterruptible power supply (UPS)

Selection Guide

Certification	Part No	Input		Output		Full Load Efficiency (%) Typ.	Max. Capacitive Load(μF)
		Voltage(VDC) (Range)	Current(mA, Typ.) Full Load/No Load	Voltage (VDC) +Vo/-Vo	Current (mA) +Io/-Io		
--	QA053-1509R3S	5 (4.5-5.5)	383/33	+15.0/-8.7	+80/-40	77/81	1000
	QA123-1509R3S	12 (10.8-13.2)	231/16	+15.0/-9.0	+100/-100	82/87	2200
	QAW123-1509R3S	12 (9-15)	231/16				1000
	QA153-1509R3S	15 (13.5-16.5)	189/16				2200
	QA243-1509R3S	24 (21.6-26.4)	123/13			77/82	2200

Note:*The specified maximum capacitive load for positive and negative output is identical.

Input Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Input Voltage (1sec. max.)	Vin=5VDC	DC	-0.7	--	9	VDC
	Vin=12VDC	DC	-0.7	--	18	
	Vin=15VDC	DC	-0.7	--	21	
	Vin=24VDC	DC	-0.7	--	30	
Input Filter			Capacitance Filter			
Hot Plug			Unavailable			

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Output Specifications

Item			Operating Conditions	Min.	Typ.	Max.	Unit
Output Voltage	QA053-1509R3S	+Vo	Vin=5VDC, Pin6 & Pin7 +Io= +80mA	14.40	15.15	15.90	VDC
		-Vo	Vin=5VDC, Pin5 & Pin6 -Io= -40mA	-8.18	-8.61	-9.05	
	QA123-1509R3S	+Vo	Vin=12VDC, Pin6 & Pin7 +Io= +100mA	13.88	14.63	15.38	
		-Vo	Vin=12VDC, Pin5 & Pin6 -Io= -100mA	-8.64	-9.09	-9.54	
	QAW123-1509R3S	+Vo	Vin=12VDC, Pin6 & Pin7 +Io= +100mA	13.88	14.63	15.38	
		-Vo	Vin=12VDC, Pin5 & Pin6 -Io= -100mA	-8.64	-9.09	-9.54	
	QA153-1509R3S	+Vo	Vin=15VDC, Pin6 & Pin7 +Io= +100mA	14.10	14.85	15.60	
		-Vo	Vin=15VDC, Pin5 & Pin6 -Io= -100mA	-8.64	-9.09	-9.54	
	QA243-1509R3S	+Vo	Vin=24VDC, Pin6 & Pin7 +Io= +100mA	14.25	15.00	15.75	
		-Vo	Vin=24VDC, Pin5 & Pin6 -Io= -100mA	-8.28	-8.73	-9.18	
Voltage Accuracy			10% - 100% load	See output regulation curve (Fig. 2- Fig. 9)			
Linear Regulation	5V Input model		Full voltage input range +Vo Output	--	±1.1	±1.4	--
			Full voltage input range -Vo Output	--	±1.1	±1.4	
	Other model		Full voltage input range +Vo Output	--	±1.1	±1.5	
			Full voltage input range -Vo Output	--	±1.1	±1.5	
Load Regulation	5V Input model		10% - 100% load +Vo Output	--	8	15	%
			10% - 100% load -Vo Output	--	10	15	
	QA(W)123-1509R3S		10% - 100% load +Vo Output	--	11	17	
			10% - 100% load -Vo Output	--	13	17	
	Other model		10% - 100% load +Vo Output	--	6	15	
			10% - 100% load -Vo Output	--	8	15	
Temperature Coefficient			Full load	--	±0.04	±0.1	%/℃
Ripple & Noise*	5V Input model		20MHz bandwidth	--	50	150	mVp-p
	Other Input model		20MHz bandwidth	--	50	100	
Short-circuit Protection				Continuous, self-recovery			

Note:* The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information.

General Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Isolation	Input-output, Test for 1 minute with a leakage current of 1mA max		5000	--	--	VAC
Continuous barrier withstand voltage	Input- output (According to 61800-5-1)		1700	--	--	V
CMTI	Input- output		±200	--	--	kV/μs
Insulation Resistance	Input-output resistance at 500VDC		1000	--	--	MΩ
Isolation capacitor	Input- output, capacitor at 100kHz/0.1V	(QAxx3-R3S) 5V Input model	--	5	6.5	pF
		Other model	--	3.5	5	
Operating Temperature	Derating when operating temperature≥85℃, (see Fig. 1)		-40	--	105	℃
Storage Temperature			-55	--	125	
Pin Soldering Resistance Temperature	Soldering spot is 1.5mm away from case for 10s seconds		--	--	300	
Case Temperature Rise	Ta=25℃, nominal input voltage, full load		--	30	60	
Storage Humidity	Non-condensing		5	--	95	%RH
Switching Frequency	Full load, nominal input voltage		--	200	--	kHz
Safety Standard	See Selection Guide		--			
Safety Class			CLASS III			
MTBF	MIL-HDBK-217F@25℃		3500	--	--	k hours

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Mechanical Specifications

Case Material	Black plastic; flame-retardant and heat-resistant
Dimensions	19.50 x 9.80 x 12.50mm
Weight	4.3g(Typ.)
Cooling Method	Free air convection

Electromagnetic Compatibility (EMC)

Emissions	CE	5V Input model	CISPR32/EN55032	CLASS B (see Fig.17 for recommended circuit)
		Other Input model	CISPR32/EN55032	CLASS A (see Fig.17 for recommended circuit)
	RE	5V Input model	CISPR32/EN55032 CISPR32/EN55032	CLASS A (see Fig.17 for recommended circuit) CLASS B (see Fig.18for recommended circuit)
		Other Input model	CISPR32/EN55032	CLASS A (see Fig.17 for recommended circuit)
Immunity	ESD	5V Input model	IEC/EN61000-4-2	Contact ±6kV perf. Criteria B
		Other Input model	IEC/EN61000-4-2	Contact ±8kV perf. Criteria B

Typical Characteristic Curves

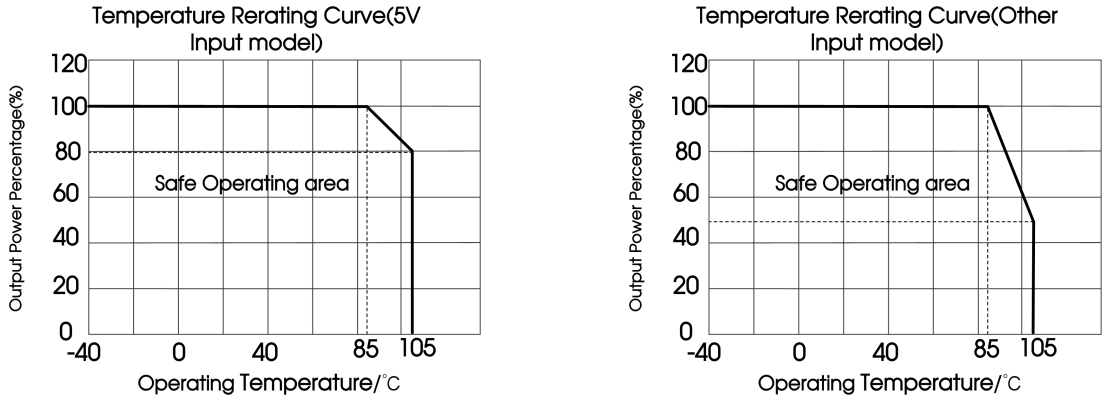

Fig. 1

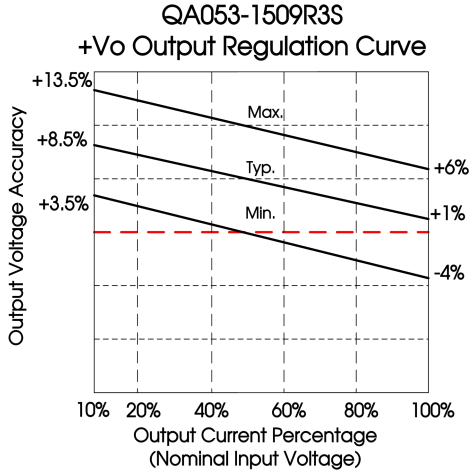

Fig. 2

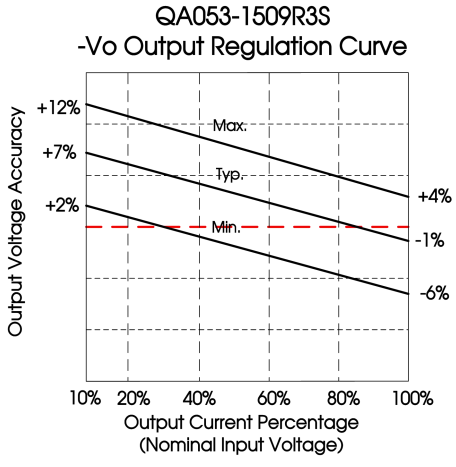

Fig. 3

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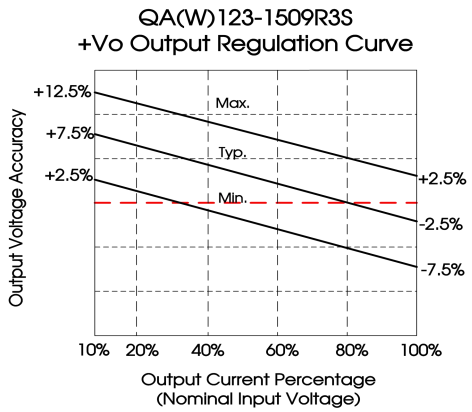

Fig. 4

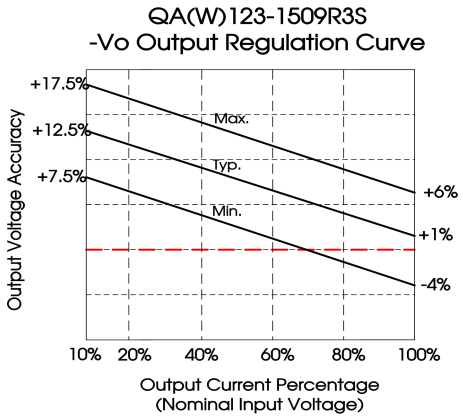

Fig. 5

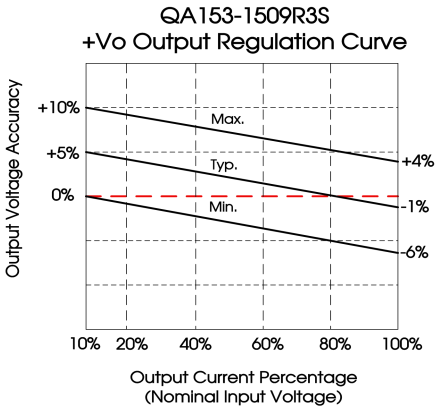

Fig. 6

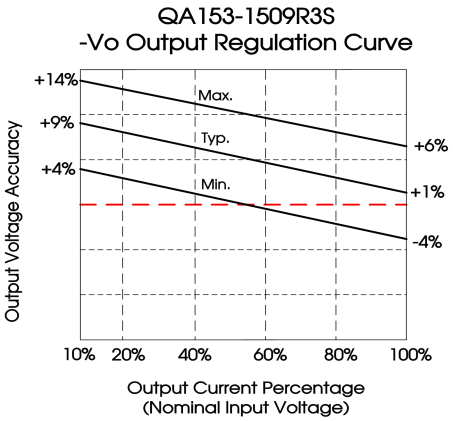

Fig. 7

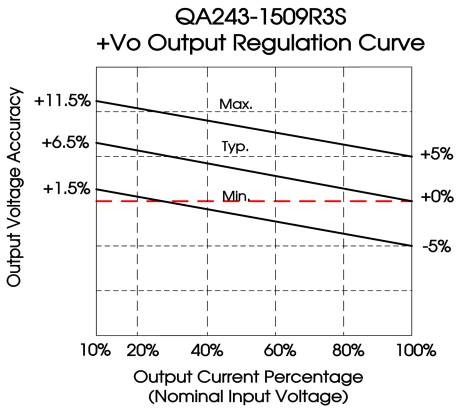

Fig. 8

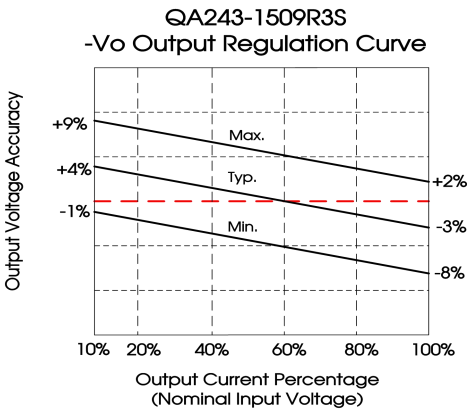

Fig. 9

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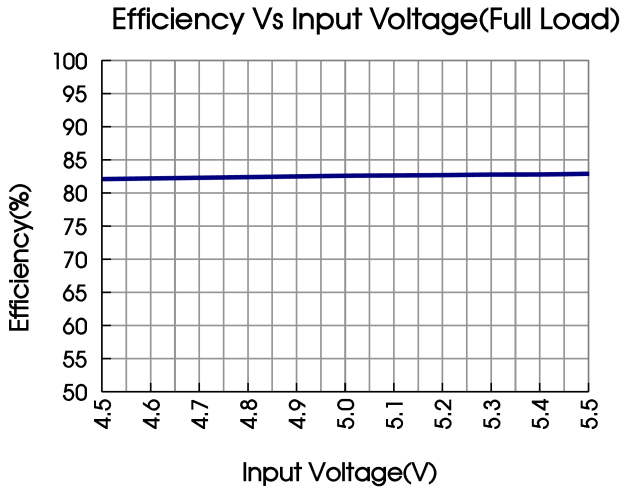

Fig. 10

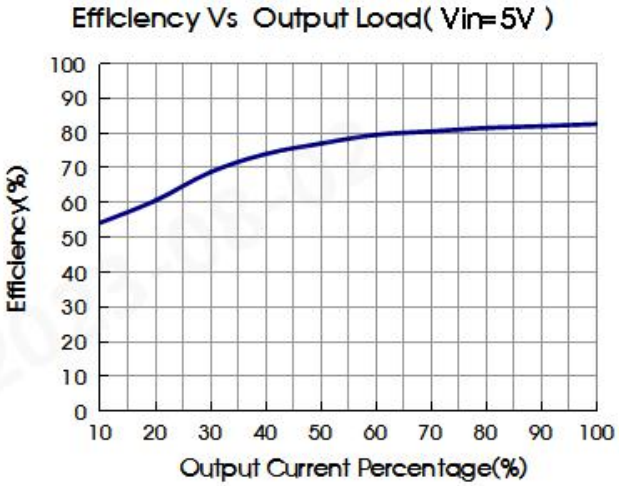

Fig.11

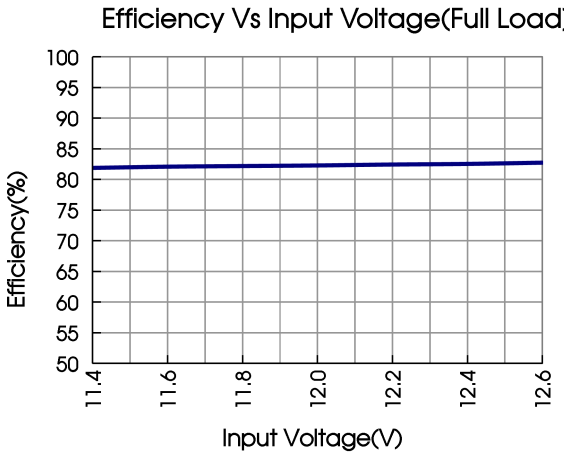

Fig. 12

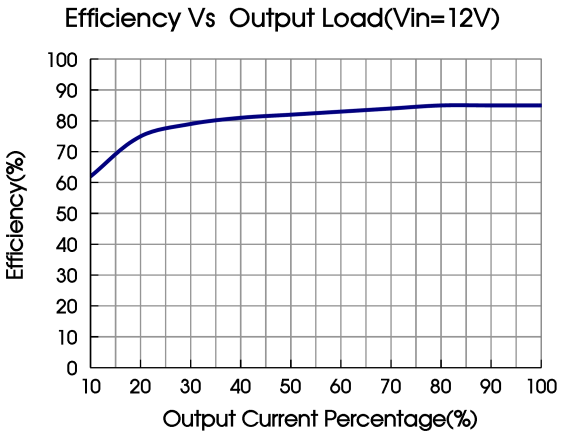

Fig. 13

Note: Take QA053-1509R3 and QA123-1509R3 as an example, other models can be corresponding reference

Design Reference

1. Test configurations

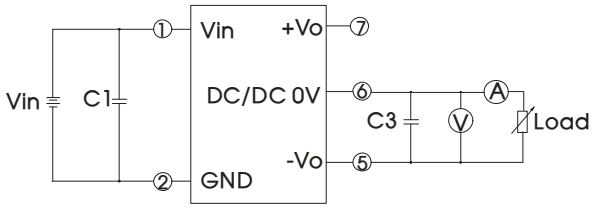

Fig. 14

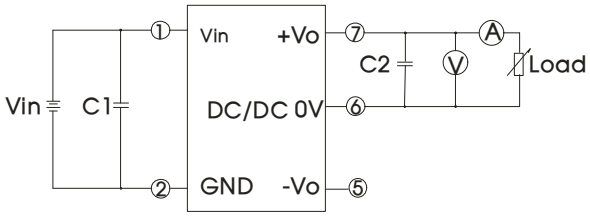

Fig.15

Note: C1, C2, C3: 100μF/35V(low resitors)

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2. Typical application

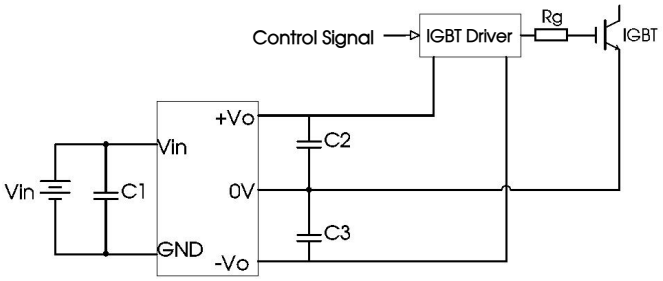

Fig. 16

C1/C2/C3
100μF/35V(Low internal resistance)

3. EMC typical recommended circuit (CLASS A)

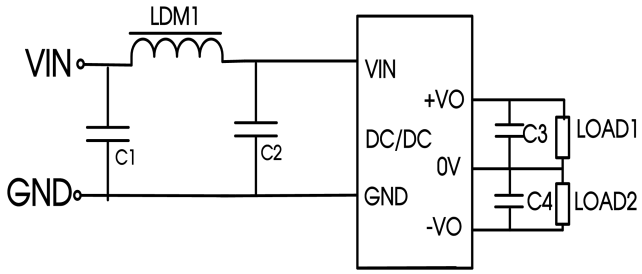

Fig. 17

Device selection			
Project		5V Input model	Other Input model
EMI	C1/C2	4.7μF /16V	1μF/50V
	C3/C4	10μF /50V (Low internal resistance)	100μF/30V (Low internal resistance)
	LDM	6.8μH	33μH

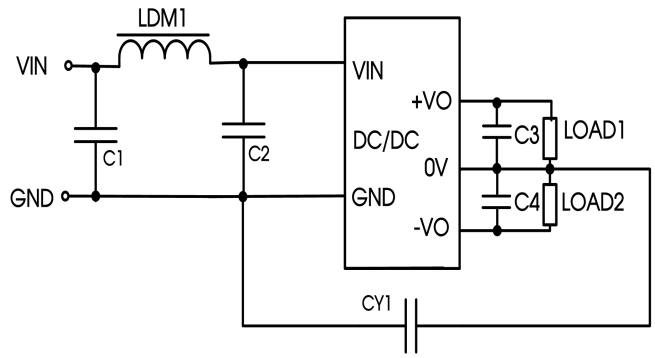

Fig. 18

Device selection		
EMI	C1/C2	4.7μF /16V
	C3/C4	10μF /50V(Low internal resistance)
	LDM	6.8μH
	CY1	330pF

4. Electrolytic capacitors are recommended for external capacitors at the input or output of the product. Tantalum capacitors are not, otherwise there is a risk of failure.

5. The products do not support parallel connection of their output for power expansion purpose or hot-plug.

6. For more information please find the application notes on www.mornsun-power.com

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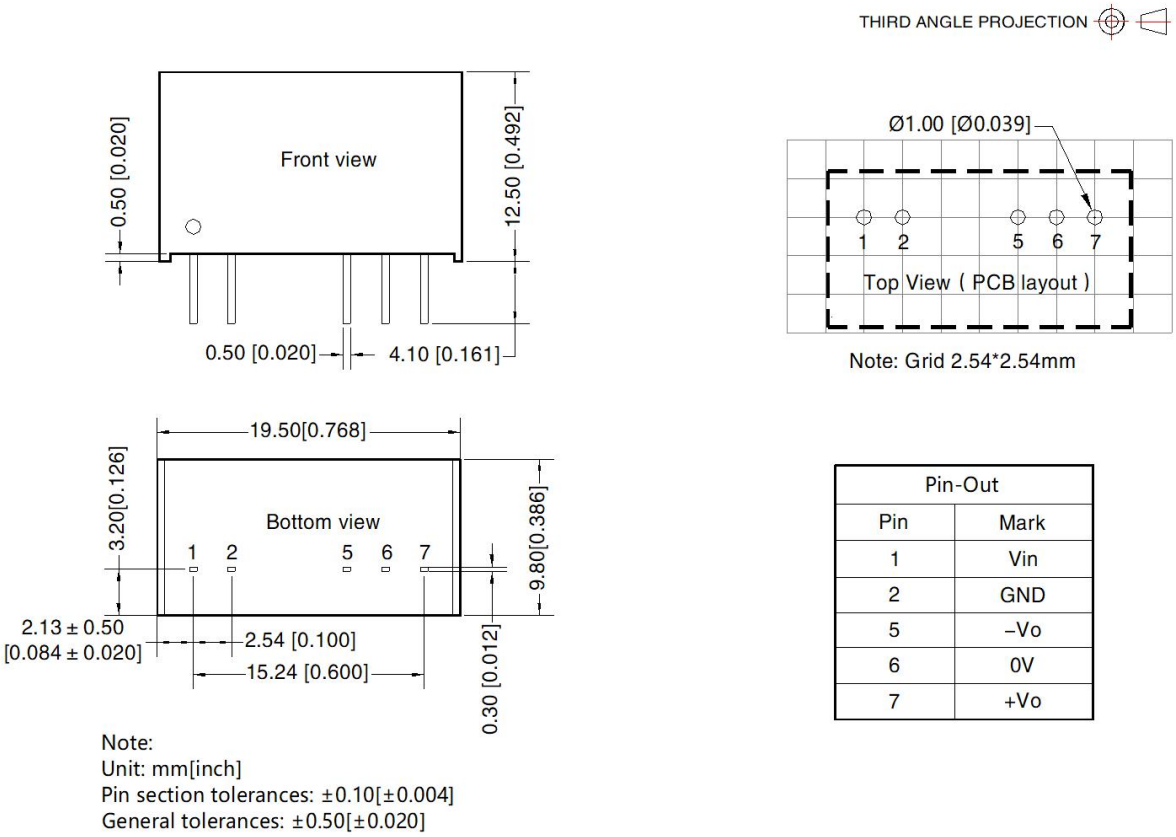
Dimensions and Recommended Layout



Note:
Unit: mm[inch]
Pin section tolerances: ±0.10[±0.004]
General tolerances: ±0.50[±0.020]

Pin-Out	
Pin	Mark
1	Vin
2	GND
5	–Vo
6	0V
7	+Vo

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58200013;
2. The lead connecting the power supply module and IGBT driver should be as short as possible during use;
3. The output filtering capacitor should be as close as possible to the power supply module and IGBT driver;
4. The peak of the IGBT driver gate drive current is high, so low internal resistance electrolytic capacitor is recommended to be used for the power supply module output filter capacitor;
5. The average output power of the driver must be lower than that of the power supply module;
6. Consider fixing with glue near the module if being used in vibration occasion;
7. The maximum capacitive load offered were tested at nominal input voltage and full load;
8. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
9. All index testing methods in this datasheet are based on company corporate standards;
10. The above are the performance indicators of the product models listed in this datasheet. Some indicators of non-standard models will exceed the above requirements. For details, please contact our technical staff;
11. Products are related to laws and regulations: see "Features" and "EMC".
12. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units;
13. We can provide product customization service, please contact our technicians directly for specific information.

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