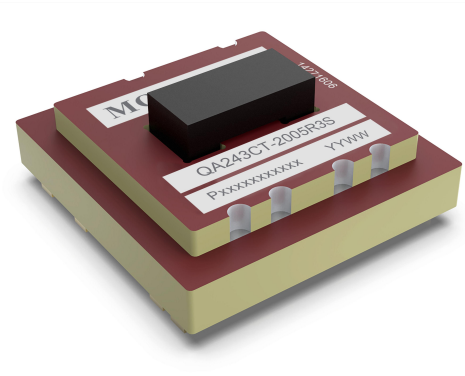
DC/DC Converter for SiC Driver

QAxx3CT-R3S Series

MORNSUN®

SiC MOSFET driver power supply



patent protection RoHS

FEATURES

- Reinforced insulation
- Ultra-low isolation capacitance: 2.5pF(typ.)
- I/O isolation test voltage: 5.0kVAC
- Partial Discharge 2.5kV
- CMTI>200 kV/μs
- Max. Capacitive Load: 2200μF
- High efficiency up to 86%
- Operating ambient temperature range: -40℃ to +105℃
- Continuous short-circuit protection
- SMD package
- Power 2.4W
- MSL 1
- AEC-Q100 experiment

The QAxx3CT-R3S series is a DC-DC module power supply designed for SiC MOSFET drives, which uses asymmetric voltage output to minimize the drive loss of SiC MOSFET. At the same time with output short circuit protection and self-recovery ability. The product is suitable for:

1.General frequency converter

2.AC servo drive system

3.Arc welder

4.Uninterruptible power supply (UPS)

Selection Guide

Certification	Part No.	Inport		Output		Full load efficiency(%) Min./Typ.	Max.Capacitive Load(μF)
		input voltage(VDC) (Range)	input currenton (mA,Typ.) Full / No load	Voltage(VDC) +Vo/-Vo	Current (mA) +Io/-Io		
--	QA123CT-2005R3S	12 (10.8-13.2)	240/9	+20/-5	+90/-90	80/86	1000
	QA123CT-1803R3S	12 (10.8-13.2)	220/9	+18/-3	+100/-100		1000
	QA123CT-1504R3S	12 (10.8-13.2)	190/9	+15/-4	+100/-100		1000
	QA153CT-2005R3S	15 (13.5-16.5)	180/8	+20/-5	+90/-90		2200
	QA153CT-1803R3S	15 (13.5-16.5)	170/8	+18/-3	+100/-100		2200
	QA153CT-1504R3S	15 (13.5-16.5)	180/8	+15/-4	+120/-120		2200
	QA243CT-2005R3S	24 (21.6- 26.4)	120/7	+20/-5	+90/-90	77/81	2200
	QA243CT-1803R3S	24 (21.6- 26.4)	110/7	+18/-3	+100/-100		2200
	QA243CT-1504R3S	24 (21.6- 26.4)	120/7	+15/-4	+120/-120		2200

Note: * The output capacitive load per channel is the same.

Limiting Character

Project	Operating Conditions	Min.	Typ.	Max.	Unit
Reflux welding temperature	--	The peak temperature Tc 245℃, the time above 217℃ is maximum 60s, Refer to the IPC / JEDEC J-STD-020D.1 standard for practical application.			

Input Specifications

Item		Operating Conditions	Min.	Typ.	Max.	Unit
Input Voltage (1sec. max.)	Vin=12VDC	DC	-0.7	--	18	VDC
	Vin=15VDC	DC	-0.7	--	21	
	Vin=24VDC	DC	-0.7	--	30	
Input the filter type			Capacitor filtering			
Hot plug			Unavailable			

Output Specifications

Item			Operating Conditions	Min.	Typ.	Max.	Unit
Output voltage	QA123CT-2005R3S	+Vo	Vin=12VDC, Pin7 & Pin10 +Io= +90mA	18.20	19.20	20.20	VDC
		-Vo	Vin=12VDC, Pin7 & Pin8 -Io= -90mA	-4.75	-5.00	-5.25	
	QA123CT-1803R3S	+Vo	Vin=12VDC, Pin9 & Pin10 +Io= +100mA	17.10	18.00	18.90	
		-Vo	Vin=12VDC, Pin7 & Pin9 -Io= -100mA	-2.85	-3.00	-3.15	
	QA123CT-1504R3S	+Vo	Vin=12VDC, Pin9 & Pin10 +Io= +100mA	14.25	15.00	15.75	
		-Vo	Vin=12VDC, Pin7 & Pin9 -Io= -100mA	-3.60	-3.80	-4.00	
	QA153CT-2005R3S	+Vo	Vin=15VDC, Pin7 & Pin10 +Io= +90mA	18.40	19.40	20.40	
		-Vo	Vin=15VDC, Pin7 & Pin8 -Io= -90mA	-4.75	-5.00	-5.25	
	QA153CT-1803R3S	+Vo	Vin=15VDC, Pin9 & Pin10 +Io= +100mA	16.38	17.28	18.18	
		-Vo	Vin=15VDC, Pin7 & Pin9 -Io= -100mA	-2.94	-3.09	-3.24	
	QA153CT-1504R3S	+Vo	Vin=15VDC, Pin9 & Pin10 +Io= +120mA	13.65	14.40	15.15	
		-Vo	Vin=15VDC, Pin7 & Pin9 -Io= -120mA	-3.72	-3.92	-4.12	
	QA243CT-2005R3S	+Vo	Vin=24VDC, Pin7 & Pin10 +Io= +90mA	19.00	20.00	21.00	
		-Vo	Vin=24VDC, Pin7 & Pin8 -Io= -90mA	-4.70	-4.95	-5.20	
	QA243CT-1803R3S	+Vo	Vin=24VDC, Pin9 & Pin10 +Io= +100mA	17.10	18.00	18.90	
		-Vo	Vin=24VDC, Pin7 & Pin9 -Io= -100mA	-2.85	-3.00	-3.15	
	QA243CT-1504R3S	+Vo	Vin=24VDC, Pin9 & Pin10 +Io= +120mA	14.25	15.00	15.75	
		-Vo	Vin=24VDC, Pin7 & Pin9 -Io= -120mA	-3.80	-4.00	-4.20	
Voltage Accuracy			10% -100% of load	See output regulation curve (Figure 2-Figure 19)			%
Linear Regulation	QAxx3CT-1803R3S	+Vo	Full voltage input range	--	±1.1	±1.3	--
		-Vo		--	±1.1	±1.4	
	The others	+Vo		--	±1.1	±1.3	
		-Vo		--	±1.1	±1.3	
Load Regulation	QA123CT-2005R3S	+Vo	10% - 100% load	--	8	12	%
		-Vo		--	9	12	
	QA123CT-1803R3S	+Vo		--	9	12	
		-Vo		--	12	15	
	QA123CT-1504R3S	+Vo		--	9	12	
		-Vo		--	12	15	
	QA153CT-2005R3S	+Vo		--	7	10	
		-Vo		--	8	12	
	QA153CT-1803R3S	+Vo		--	8	12	
		-Vo		--	12	15	
	QA153CT-1504R3S	+Vo		--	10	12	
		-Vo		--	12	15	
	QA243CT-2005R3S	+Vo		--	5	10	
		-Vo		--	7	10	
	QA243CT-1803R3S	+Vo		--	5	10	
		-Vo		--	9	12	

	QA243CT-1504R3S	+Vo		--	7	10	
		-Vo		--	10	12	
Temperature Coefficient			Full load	--	±0.04	±0.1	%/℃
Ripple & Noise*			20MHz bandwidth	--	50	--	mVp-p
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	--	2500	--	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	--	2.5	4	pF
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		--			
Safety Class		CLASS III			
MTBF	MIL-HDBK-217F@25℃	3500	15604	--	k hours

Mechanical Specifications

Dimensions	23.11*22.61*9.85mm
Weight	6.6g (Typ.)
Cooling Method	Natural air cold

Electromagnetic Compatibility (EMC)

Emissions	CE（12V/15V Series）	CISPR32/EN55032 CLASS B (see Table 2. for recommended circuit)
	CE（24V Series）	CISPR32/EN55032 CLASS A (see Table 2. for recommended circuit)
	RE	CISPR32/EN55032 CLASS A (see Table 2. for recommended circuit)
Immunity	ESD	IEC/EN61000-4-2 Contact ±8kV perf. Criteria B

Typical Characteristic Curves

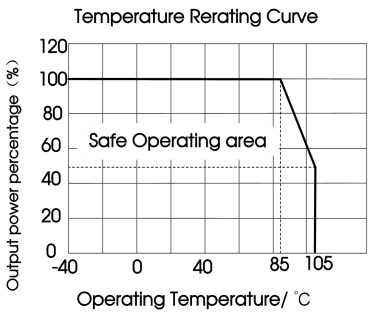


Fig.1

QA123CT-2005R3S
+Vo Output Regulation Curve

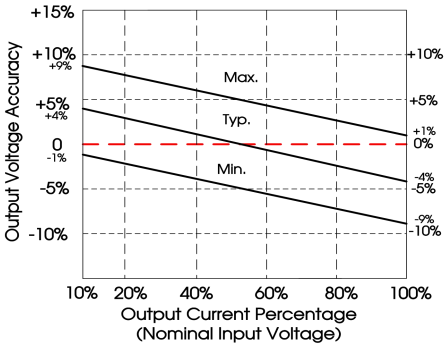


Fig.2

QA123CT-2005R3S
-Vo Output Regulation Curve

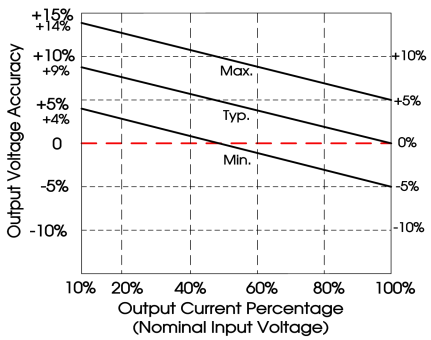


Fig.3

QA123C-1803R3S
+Vo Output Regulation Curve

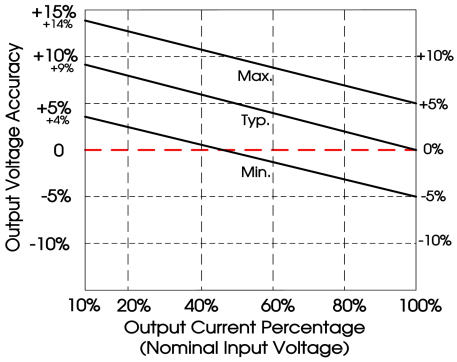


Fig.4

QA123C-1803R3S
-Vo Output Regulation Curve

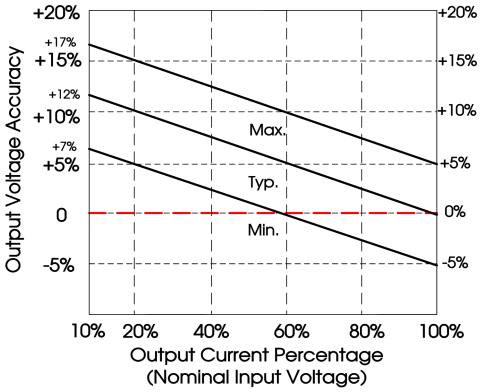


Fig.5

QA123C-1504R3S
+Vo Output Regulation Curve

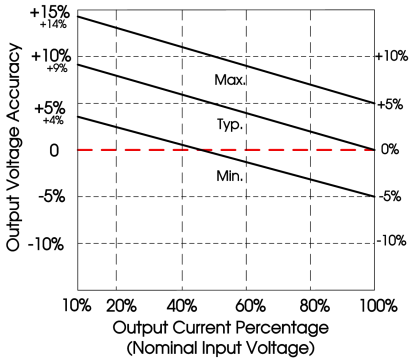


Fig.6

QA123C-1504R3S
-Vo Output Regulation Curve

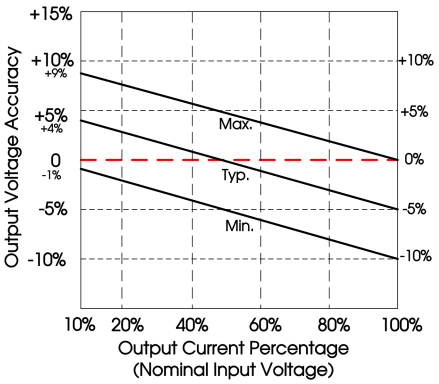


Fig.7

QA153CT-2005R3S
+Vo Output Regulation Curve

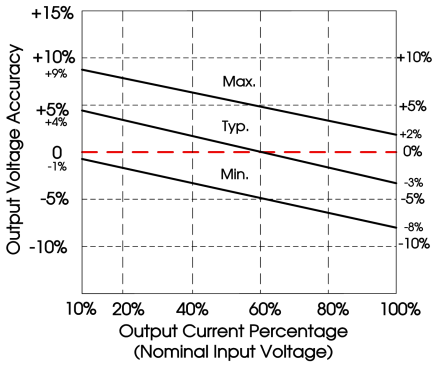


Fig.8

QA153CT-2005R3S
-Vo Output Regulation Curve

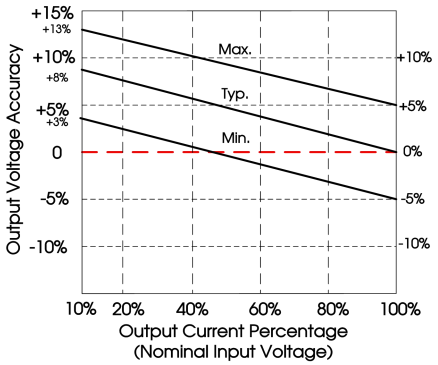


Fig.9

QA153CT-1803R3S
+Vo Output Regulation Curve

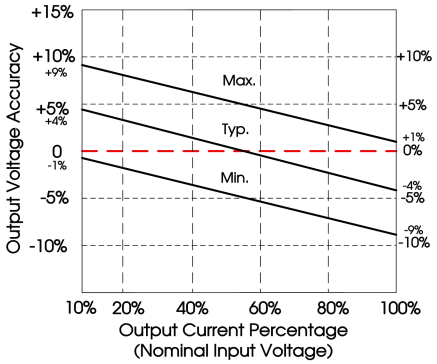


Fig.10

QA153CT-1803R3S
-Vo Output Regulation Curve

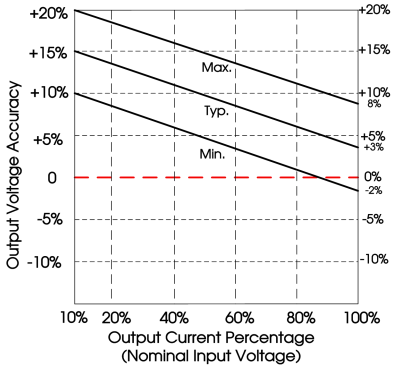


Fig.11

QA153CT-1504R3S
+Vo Output Regulation Curve

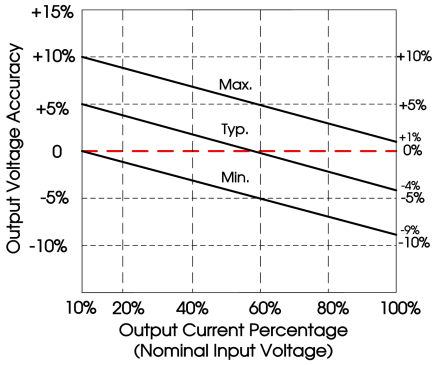


Fig.12

QA153CT-1504R3S
-Vo Output Regulation Curve

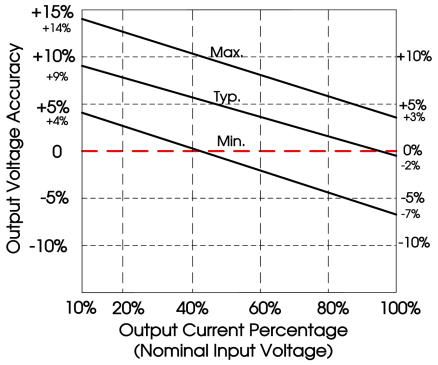


Fig.13

QA243CT-2005R3S
+Vo Output Regulation Curve

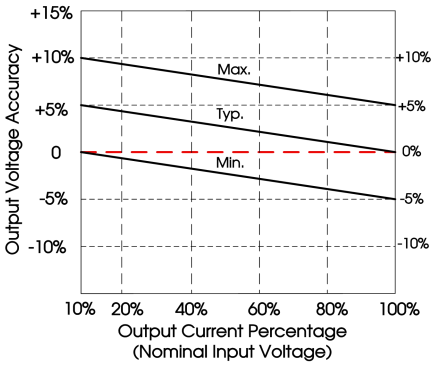


Fig.14

QA243CT-2005R3S
-Vo Output Regulation Curve

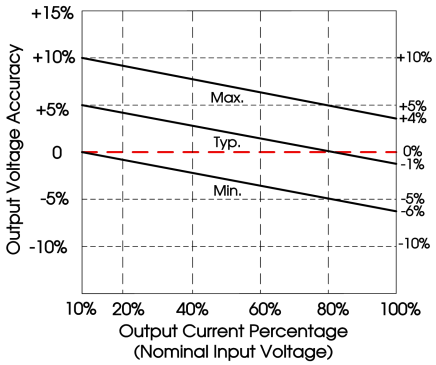


Fig.15

QA243CT-1803R3S
+Vo Output Regulation Curve

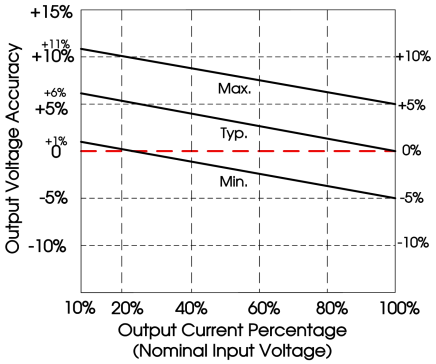


Fig.16

QA243CT-1803R3S
-Vo Output Regulation Curve

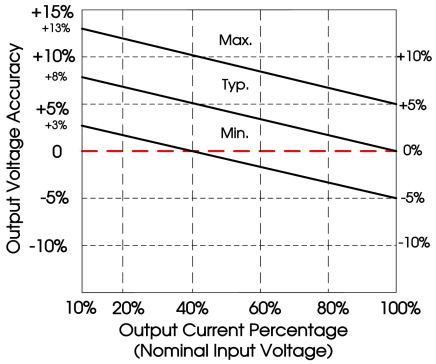


Fig.17

QA243CT-1504R3S
+Vo Output Regulation Curve

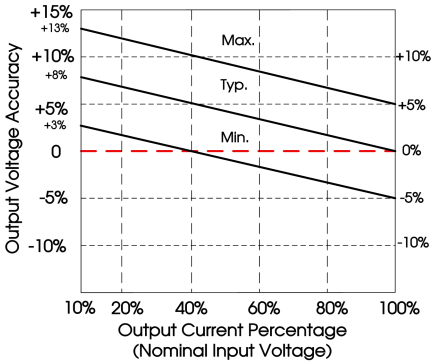


Fig.18

QA243CT-1504R3S
-Vo Output Regulation Curve

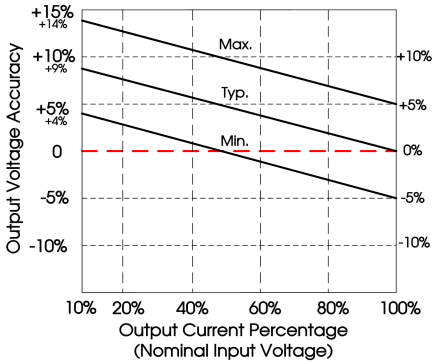


Fig.19

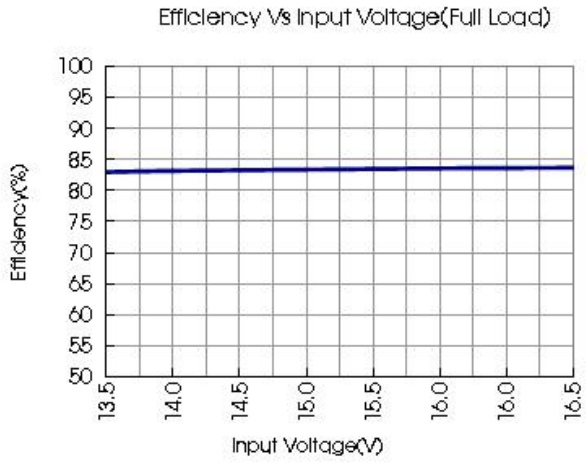


Fig.20

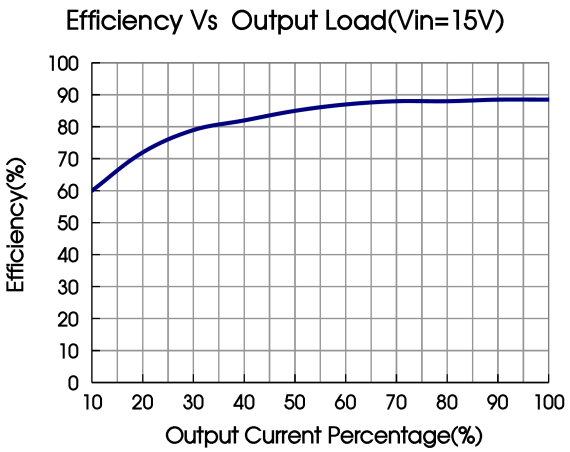


Fig.21

Note: Take QA153CT-2005R3S as an example, other models can be corresponding reference

Design Reference

1. Test configurations

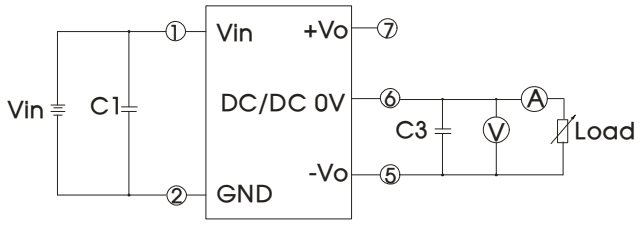


Fig.22

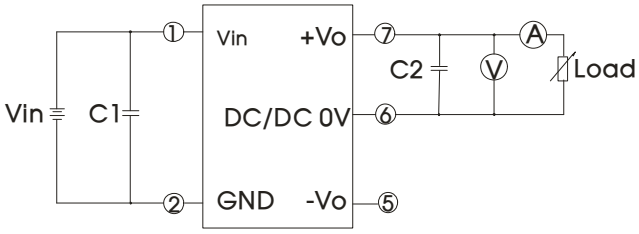


Fig.23

Note: C1, C2, and C3, respectively, are 100 μF / 35V (low internal resistance capacitance)

2. Typical applications

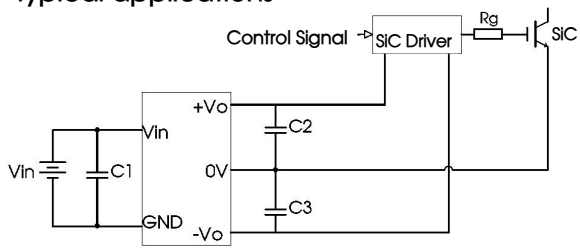


Fig.24

Table 1.

C1/C2/C3
100 μ F / 35V (low internal resistance capacitor)

3. EMC typical recommended circuit

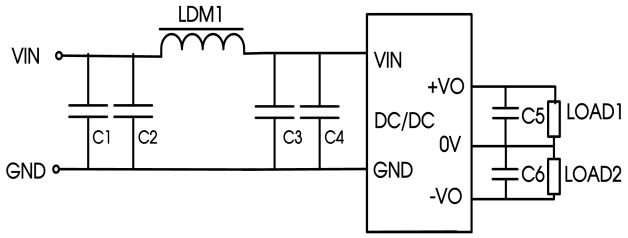


Fig.25

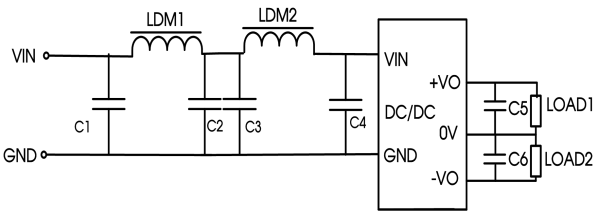


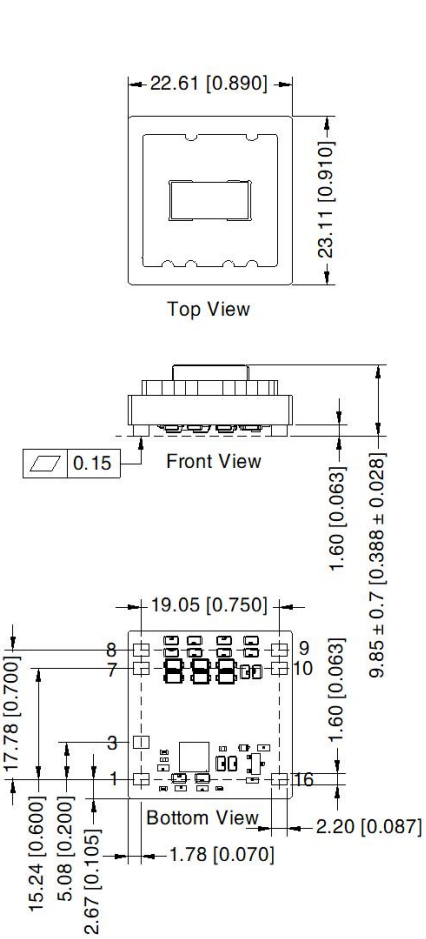
Fig.26

Table 2.

Part No.	Recommended circuit	C1	C2	C3	C4	LDM1	LDM2
QA123CT-2005R3S	Fig.25	1μF/50V	0.1μF/50V	1μF/50V	0.1μF/50V	33μH	——
QA123CT-1803R3S	Fig.25	1μF/50V	0.1μF/50V	1μF/50V	0.1μF/50V	27μH	——
QA123CT-1504R3S							
QA153CT-2005R3S							
QA153CT-1803R3S							
QA153CT-1504R3S	Fig.26	4.7μF/50V	4.7μF/50V	0.1μF/50V	0.1μF/50V	33μH	33μH
QA243CT-2005R3S							
QA243CT-1803R3S	Fig.25	4.7μF/50V	0.1μF/50V	4.7μF/50V	0.1μF/50V	33μH	——
QA243CT-1504R3S							

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

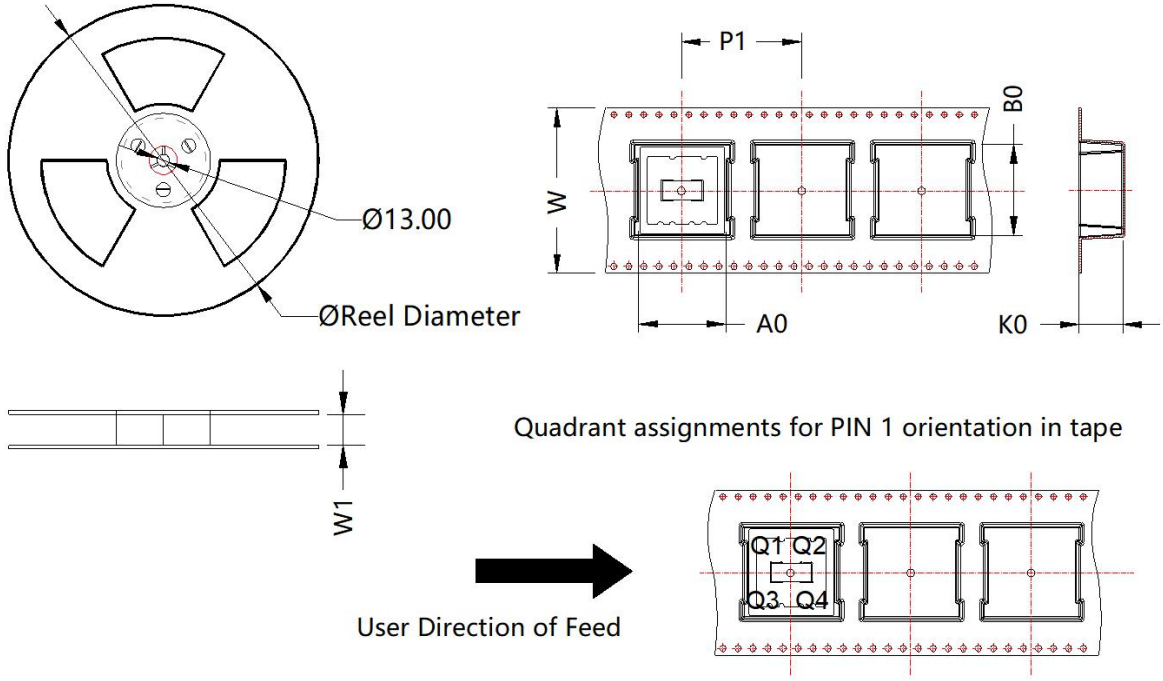
Dimensions and Recommended Layout



Pin-Out	QAXX3CT-1803R3S QAXX3CT-1504R3S	QAXX3CT-2005R3S
Pin	Mark	Mark
1	GND	GND
3	NC	NC
7	-V0	0V
8	NC	-V0
9	0V	NC
10	+V0	+V0
16	VCC	VCC

Note:
Unit: mm[inch]
Pin size tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]
The layout of the device is for reference only, please refer to the actual product

Package diagram:



Device	MPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
QAxx3CT-xxxxR3S	170	180.0	44.5	23.78	24.28	11.6	32.0	44.0	Q1

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58070018;
2. The leads for the module and SIC drives are as short as possible;
3. The output filtering capacitor should be as close as possible to the power supply module and SiC driver;
4. The peak of the SiC 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. he 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. We can provide product customization service, please contact our technicians directly for specific information;
12. Products are related to laws and regulations: see "Features" and "EMC".
13. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

MORNSUN Guangzhou Science & Technology Co., Ltd.
Address: No. 5, Kehui St. 1, Kehui Development Center, Science Ave., Guangzhou Science City, Huangpu District, Guangzhou, P. R. China
Tel: 86-20-38601850 Fax: 86-20-38601272 E-mail: info@mornsun.cn www.mornsun-power.com