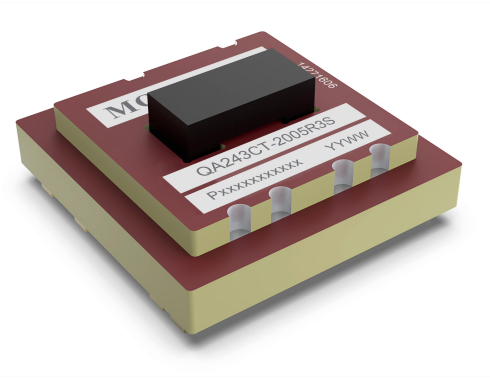
# DC/DC Converter for SiC Driver

## QAxx3CT-R3S Series

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. | | | |


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## 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 | |


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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 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

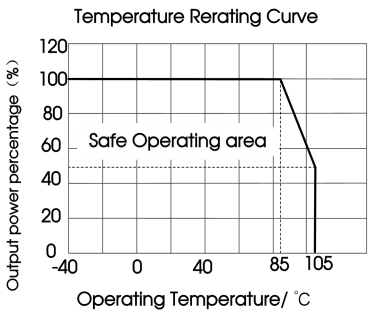



Fig.1


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QA123CT-2005R3S
+Vo Output Regulation Curve

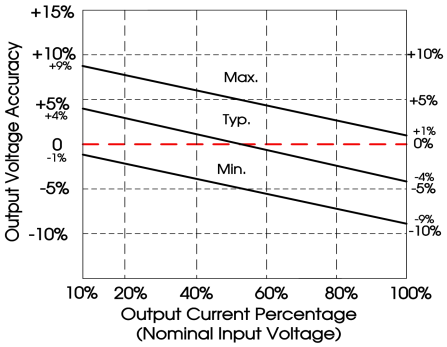



Fig.2

QA123CT-2005R3S
-Vo Output Regulation Curve

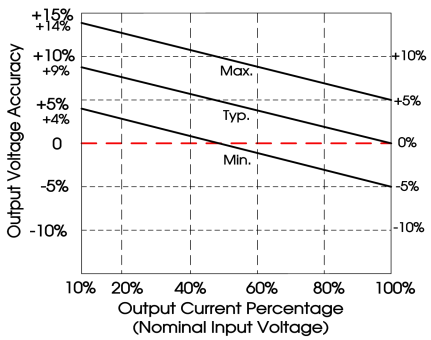



Fig.3

QA123C-1803R3S
+Vo Output Regulation Curve

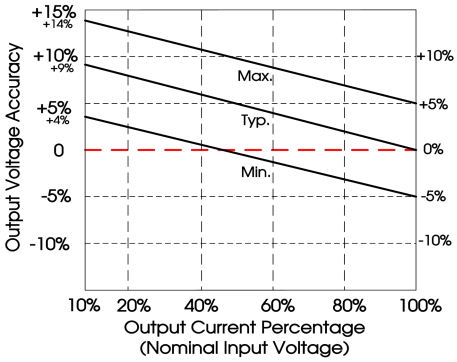



Fig.4

QA123C-1803R3S
-Vo Output Regulation Curve

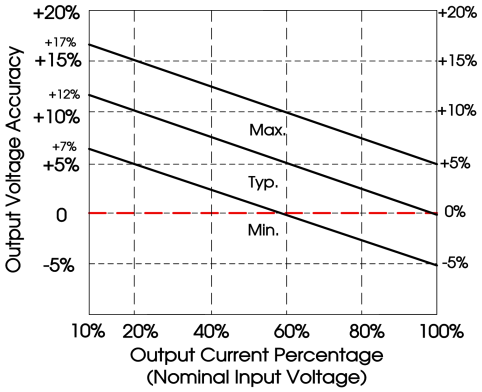



Fig.5

QA123C-1504R3S
+Vo Output Regulation Curve

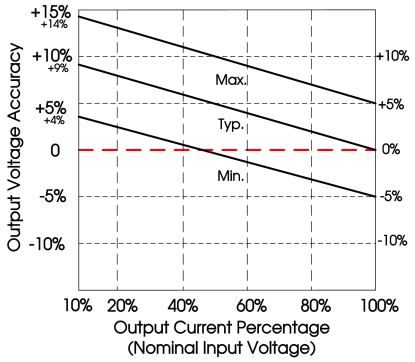



Fig.6

QA123C-1504R3S
-Vo Output Regulation Curve

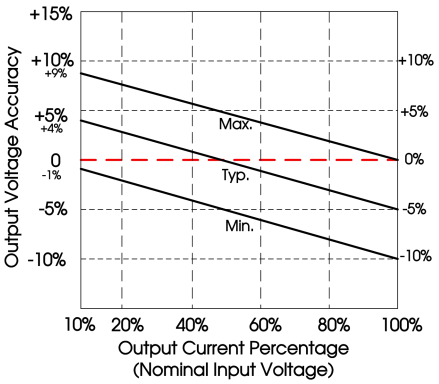



Fig.7


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QA153CT-2005R3S
+Vo Output Regulation Curve

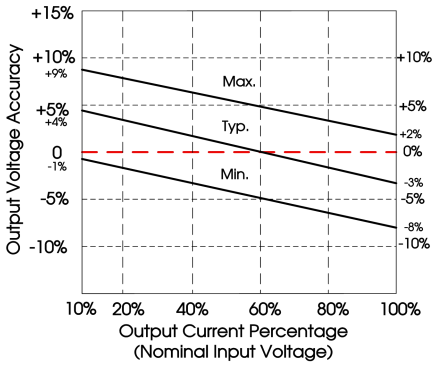



Fig.8

QA153CT-2005R3S
-Vo Output Regulation Curve

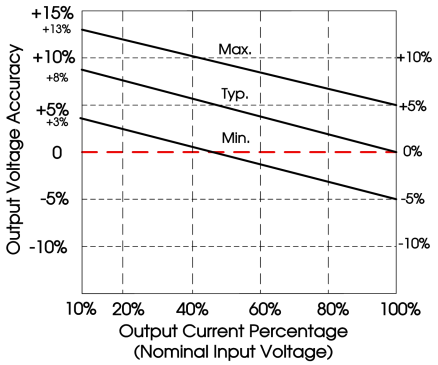



Fig.9

QA153CT-1803R3S
+Vo Output Regulation Curve

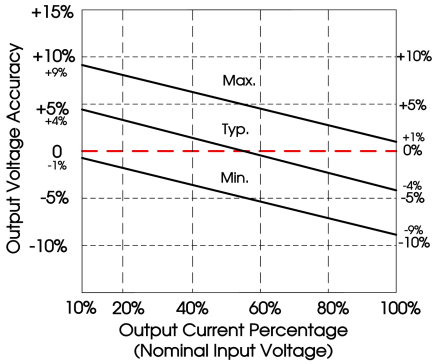



Fig.10

QA153CT-1803R3S
-Vo Output Regulation Curve

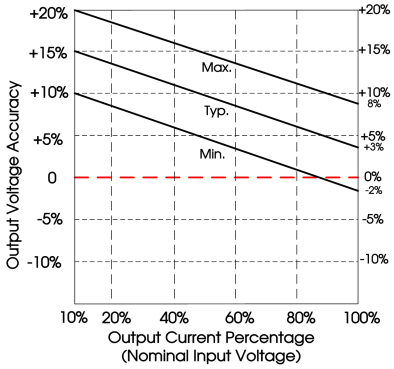



Fig.11

QA153CT-1504R3S
+Vo Output Regulation Curve

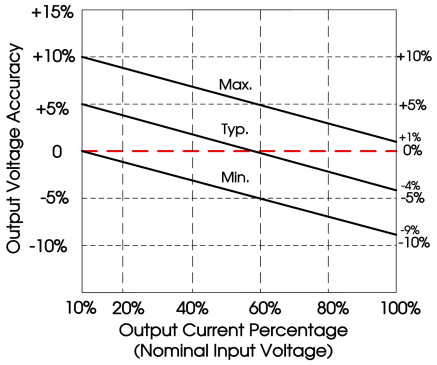



Fig.12

QA153CT-1504R3S
-Vo Output Regulation Curve

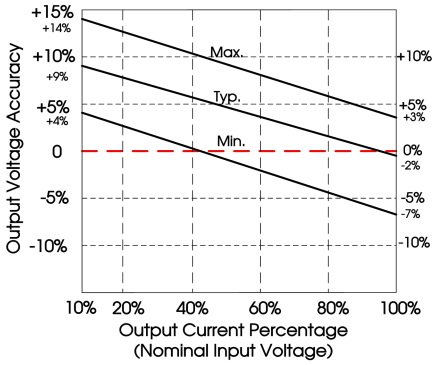



Fig.13


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QA243CT-2005R3S
+Vo Output Regulation Curve

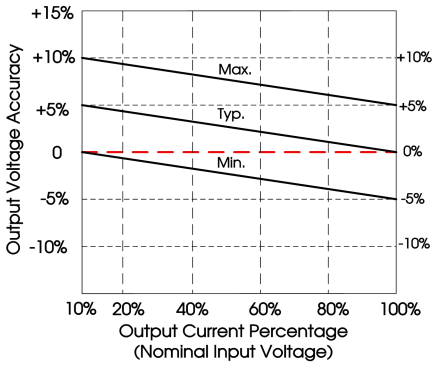



Fig.14

QA243CT-2005R3S
-Vo Output Regulation Curve

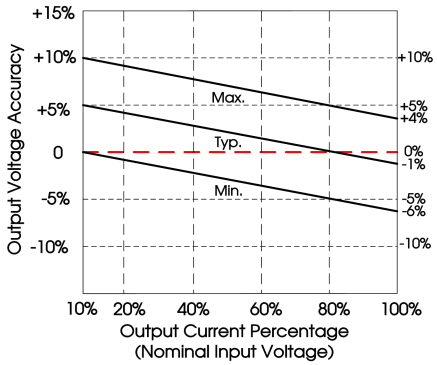



Fig.15

QA243CT-1803R3S
+Vo Output Regulation Curve

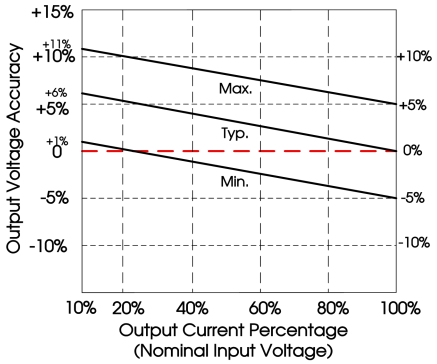



Fig.16

QA243CT-1803R3S
-Vo Output Regulation Curve

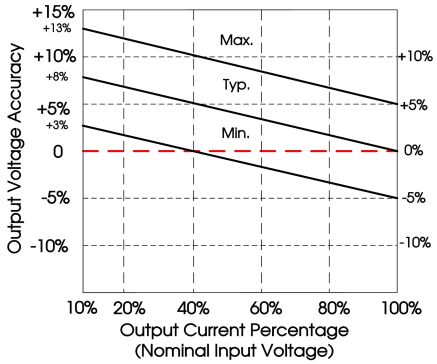



Fig.17

QA243CT-1504R3S
+Vo Output Regulation Curve

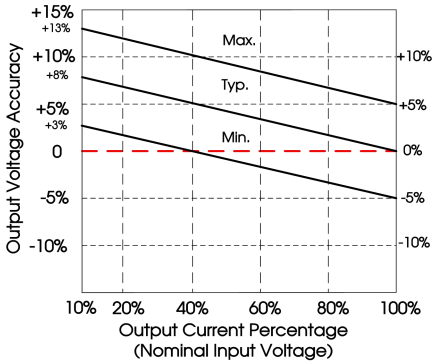



Fig.18

QA243CT-1504R3S
-Vo Output Regulation Curve

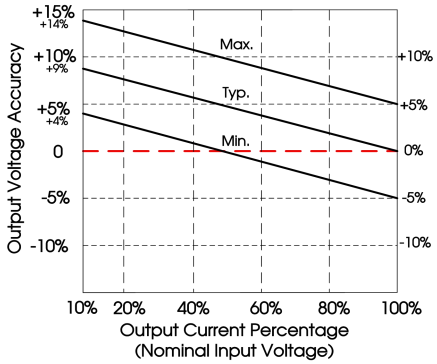



Fig.19


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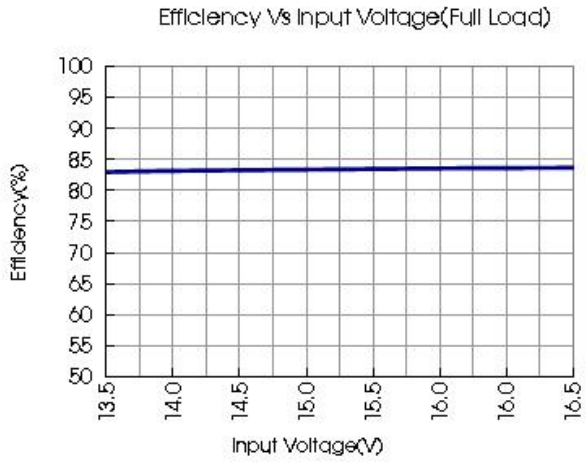



Fig.20

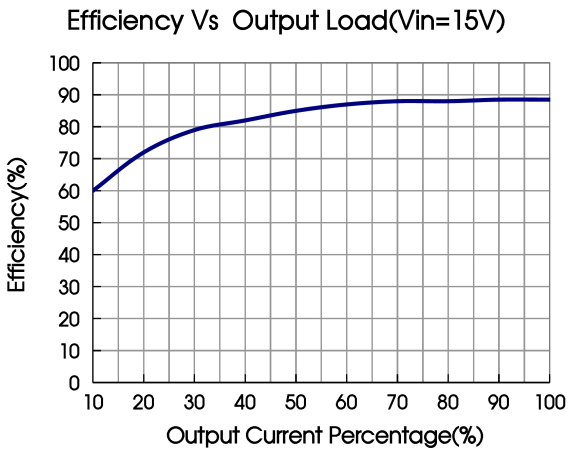



Fig.21

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

## Design Reference

### 1. Test configurations

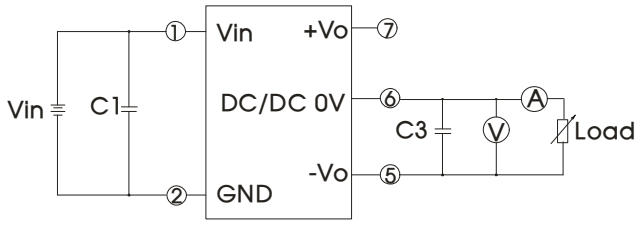



Fig.22

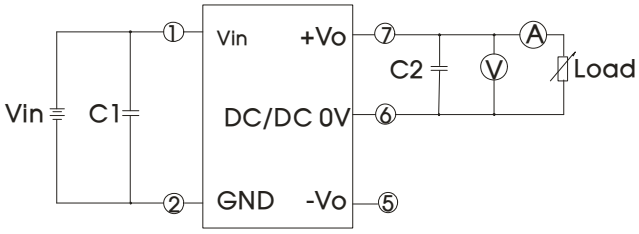



Fig.23

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

### 2. Typical applications

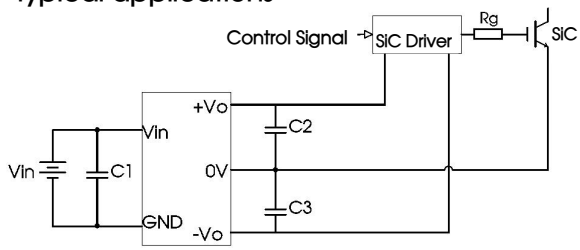



Fig.24

Table 1.

| C1/C2/C3 |
| --- |
| 100 μ F / 35V<br>(low internal resistance capacitor) |

### 3. EMC typical recommended circuit

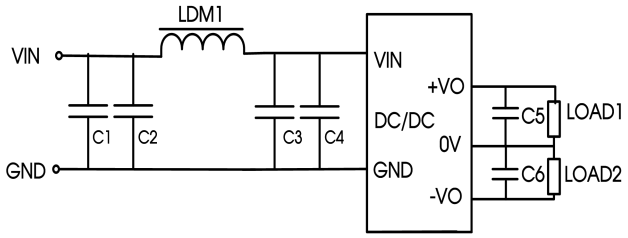



Fig.25

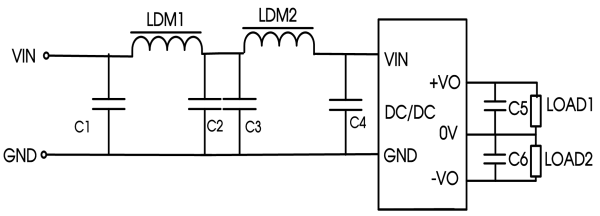



Fig.26


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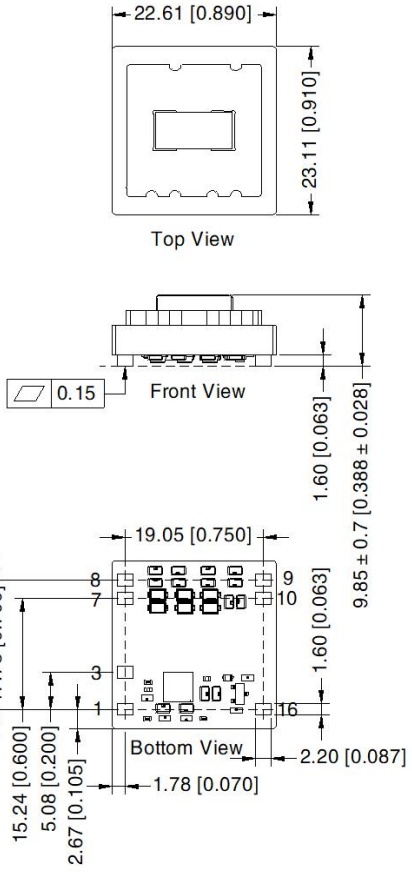
Table 2.

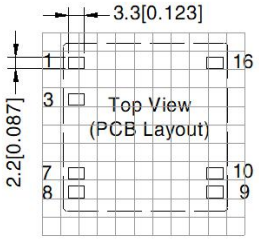
| Part No. | Recommended circuit | C1 | C2 | C3 | C4 | LDM1 | LDM2 |
|---|---|---|---|---|---|---|---|
| QA123CT-2005R3S | Fig.25 | 1μF/50V | 0.1μF/50V | 1μF/50V | 0.1μF/50V | 33μH | —— |
| QA123CT-1803R3S | Fig.25 | 1μF/50V | 0.1μF/50V | 1μF/50V | 0.1μF/50V | 27μH | —— |
| QA123CT-1504R3S | | | | |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

THIRD ANGLE PROJECTION



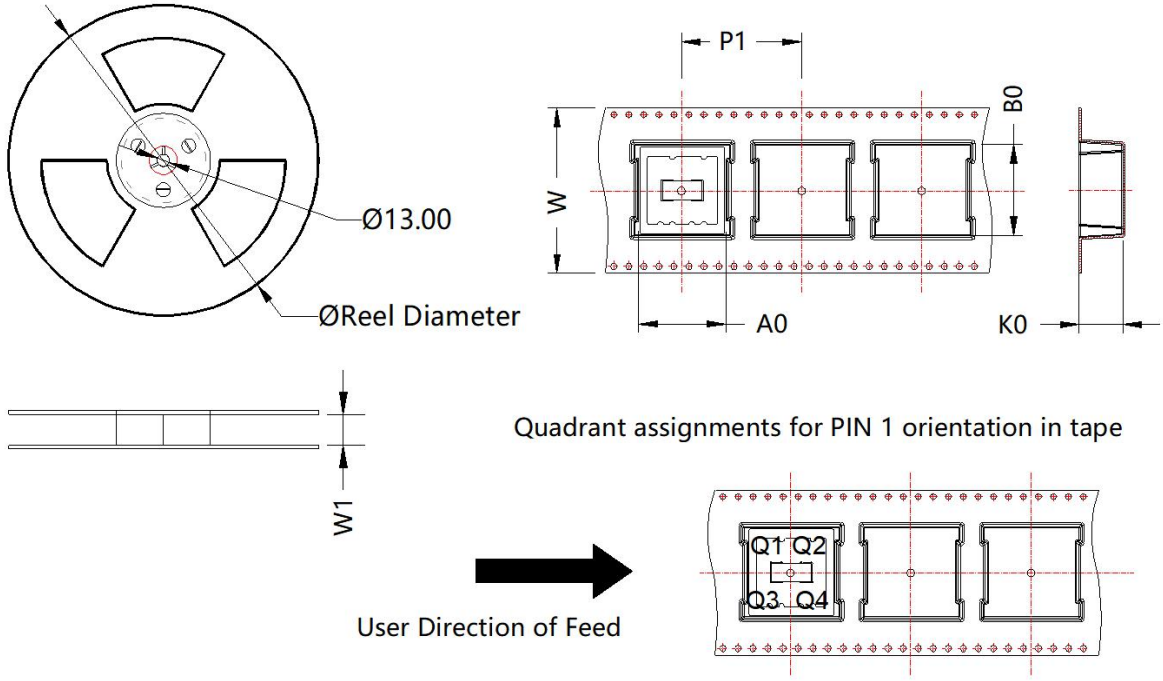

Note: Grid 2.54*2.54mm

| 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


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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.

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