# DC/DC Converter

## K12T-10A, 16A, 20A Series

MORNSUN®

Non-isolated & regulated 10A, 16A, 20A single output POL power converter


CE Report RoHS

EN 62368-1

## FEATURES

- High efficiency up to 96%
- Operating ambient temperature range: -40℃ to +85℃
- Input under-voltage protection, output short-circuit, over-current protection
- High-speed transient response
- Compact SMD package

*K12T-10A, 16A, 20A series is a 10A, 16A, 20A non-isolated switching regulator. The output voltage is accurately adjustable from 0.6V to 5.0V, and the product is featured with high efficiency, fast transient response, input under-voltage, output short circuit, over-current protection. They meet CLASS B of CISPR32/EN55032 EMI standards by adding the recommended external components and they are widely used in applications such as communications, computer network industry, power distributed architecture, workstations, servers, LANs/WANs and provide high current with fast transient response for high-speed chips such as FPGA, DSP, and ASIC.*

## Selection Guide

| Certification | Part No.① | Input Voltage (VDC) | | Output | | Efficiency(%) Min./Typ. | Capacitive Load(μF) Max. | |
|---|---|---|---|---|---|---|---|---|
| | | Nominal (Range) | Max.② | Voltage(VDC)③ (Range) | Current (A) Min./Max. | | 1 mΩ ≤ESR <10 mΩ | ESR≥10 mΩ |
| EN | K12T-10A-P | 12 (8.3-14) | 15 | 0.75-5.0 | 0/10 | 93/96 | 5000 | 6000 |
| | K12T-10A-N | | | | | | | |
| | K12T-16A-P | | | | 0/16 | 92/95 | 5000 | 6000 |
| | K12T-16A-N | | | | | | | |
| -- | K12T-20A-P | 12 (8-14) | 15 | 0.6-5.0 | 0/20 | 92/94 | 5000 | 6000 |
| | K12T-20A-N | | | | | 92/94 | | |

Notes: ① "P" indicates that the Ctrl pin is positive logic control, "N" indicates that the Ctrl pin is negative logic control;
② Exceeding the maximum input voltage may cause permanent damage;
③ The default output voltage is 0.6VDC or 0.75VDC, which can be adjusted to 1.2VDC, 1.8VDC, 2.5VDC, 3.3VDC, 5VDC. See Trim instructions for specific output voltage adjustment;
④ Unless otherwise specified, parameters in this table were measured under the 5VDC output voltage.

## Input Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input Current (full load/no-load) | Nominal input voltage | K12T-10A-P(N) | -- | 4340/70 | -- | mA |
| | | K12T-16A-P(N) | -- | 7020/70 | -- | |
| | | K12T-20A-P(N) | -- | 8865/90 | -- | |
| Start-up Voltage | K12T-10A, K12T-16A | | -- | -- | 8.3 | VDC |
| | K12T-20A | | -- | -- | 4.5 | |
| Under-voltage Protection | K12T-10A, K12T-16A | | 6.0 | -- | -- | |
| Turn-off Voltage | K12T-20A | | 4.0 | -- | -- | |
| Reverse Polarity Input | | | Avoid / Not protected | | | |
| Hot Plug | | | Unavailable | | | |
| Input Filter | | | Capacitance filter | | | |
| Ctrl* | Module on | K12T-10A-P, K12T-16A-P (Positive logic) | Ctrl pin open or pulled high(Vin-2.5V ~ Vin ) | | | |
| | | K12T-10A-N, K12T-16A-N (Negative logic) | Ctrl pin open or pulled low to GND (0 ~ 0.5 VDC) | | | |
| | | K12T-20A-P (Positive logic) | Ctrl pin open or pulled high(Vin-0.5V ~ Vin ) | | | |
| | | K12T-20A-N (Negative logic) | Ctrl pin open or pulled low to GND (0 ~ 0.5 VDC) | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Ctrl* | Module off | K12T-10A-P, K12T-16A-P (Positive logic) | Ctrl pin pulled low to GND (0 ~ 0.5VDC) | | | |
| | | K12T-10A-N, K12T-16A-N (Negative logic) | Ctrl pin pulled high (Vin-2.5V ~ Vin) | | | |
| | | K12T-20A-P (Positive logic) | Ctrl pin pulled low to GND (0 ~ 0.5VDC) | | | |
| | | K12T-20A-N (Negative logic) | Ctrl pin pulled high (Vin-0.5V ~ Vin) | | | |
| | Input current when off | | -- | 2 | -- | mA |

Notes: * 1. The Ctrl pin voltage is referenced to GND;
2. Unless otherwise specified, parameters in this table were measured under the 5VDC output voltage.

## Output Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Voltage Accuracy | Full load, nominal input voltage | | -- | ±1.0 | ±2.0 | % |
| Linear Regulation | Full load, input voltage range | | -- | ±0.3 | -- | |
| Load Regulation | Nominal input, 0% -100% load | | -- | ±0.4 | -- | |
| Ripple & Noise* | 20MHz bandwidth, nominal input, 100% load | | -- | 65 | 100 | mVp-p |
| Trim | K12T-10A, K12T-16A | | 0.75 | -- | 5.0 | VDC |
| | K12T-20A | | 0.6 | -- | 5.0 | |
| Sense | | | -- | -- | 110 | %Vo |
| Transient Response Deviation | Nominal input, 50%-100%-50% load step change, di/dt=2.5A/us, with external 470 μF polymer capacitors | K12T-10A | -- | ±75 | -- | mV |
| | | K12T-16A, K12T-20A | -- | ±100 | -- | |
| Transient Recovery Time | | K12T-10A, K12T-16A, K12T-20A | -- | 20 | -- | us |
| Over-current Protection | Nominal input | K12T-10A | -- | 320 | -- | %Io |
| | | K12T-16A, K12T-20A | -- | 200 | -- | |
| Short-circuit Protection | Nominal input | | Continuous, self-recovery | | | |
| Temperature Coefficient | 100% load | | -- | ±0.02 | -- | %/℃ |

Notes: * 1. The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information;
2. Unless otherwise specified, parameters in this table were measured under the 5VDC output voltage.

## General Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Operating Temperature | See Fig. 1 | -40 | -- | +85 | ℃ |
| Storage Temperature | | -55 | -- | +125 | |
| Storage Humidity | Non-condensing | 5 | -- | 95 | %RH |
| Reflow Soldering Temperature | | Peak temp. Tc ≤245℃, maximum duration time≤60s over 217℃. For actual application, please refer to IPC/JEDEC J-STD-020D.1. | | | |
| Switching Frequency | Full load, nominal input voltage input | -- | 300 | -- | kHz |
| MTBF | MIL-HDBK-217F@25℃ | 1000 | -- | -- | k hours |
| MSL | IPC/JEDEC J-STD-020D.1 | MSL3 | | | |

## Mechanical Specifications

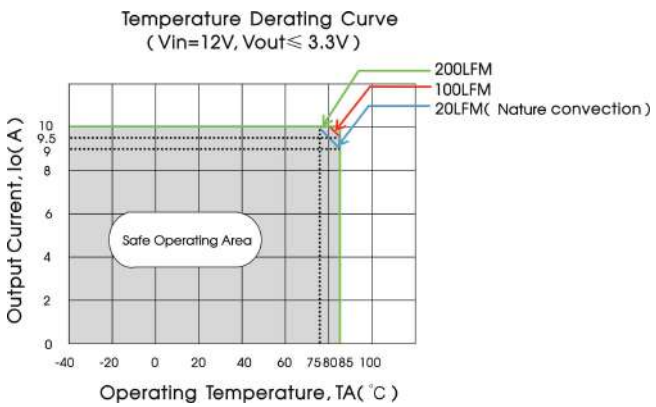
| | | |
|---|---|---|
| Dimensions | K12T-10A, K12T-16A | 33.00 x 13.50 x 8.30mm |
| | K12T-20A | 33.00 x 13.50 x 9.90mm |
| Weight | K12T-10A, K12T-16A | 8.6g (Typ.) |
| | K12T-20A | 9.2g (Typ.) |
| Cooling Method | Nature convection or forced convection | |

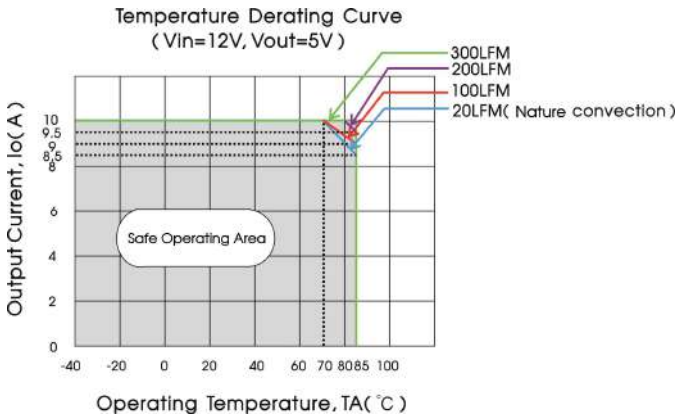
## Electromagnetic Compatibility (EMC)

| | | |
|---|---|---|
| Emissions | CE | CISPR32/EN55032 Class B (see Fig.3 for recommended circuit) |
| | RE | CISPR32/EN55032 Class B (see Fig.3 for recommended circuit) |
| Immunity | ESD | IEC/EN61000-4-2 Contact ±6kV perf. Criteria B |

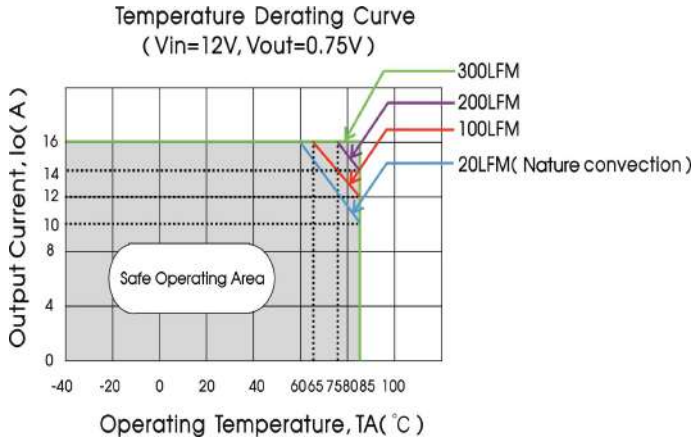
## Typical Characteristic Curves

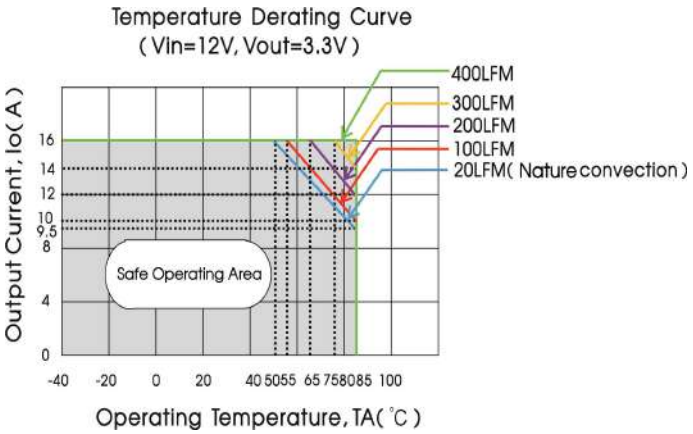
### K12T-10A Series Temperature Derating Curves

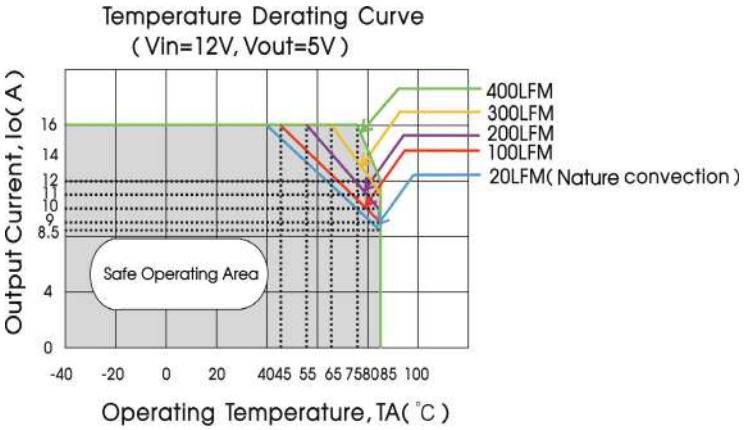



### K12T-16A Series Temperature Derating Curves



## K12T-20A Series Temperature Derating Curves

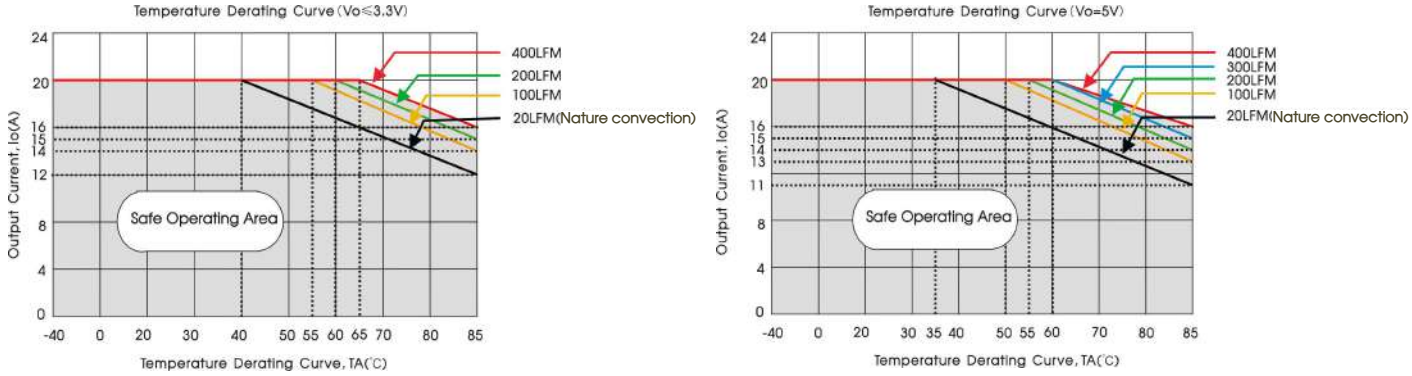
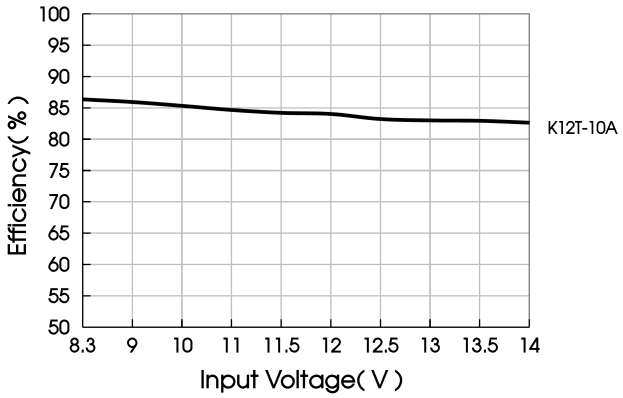


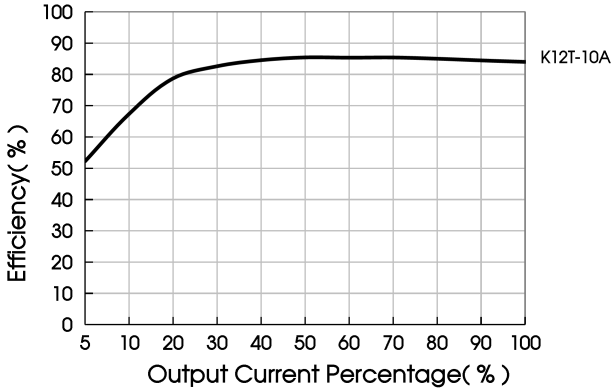

Fig .1

## K12T-10A Series Efficiency Curves

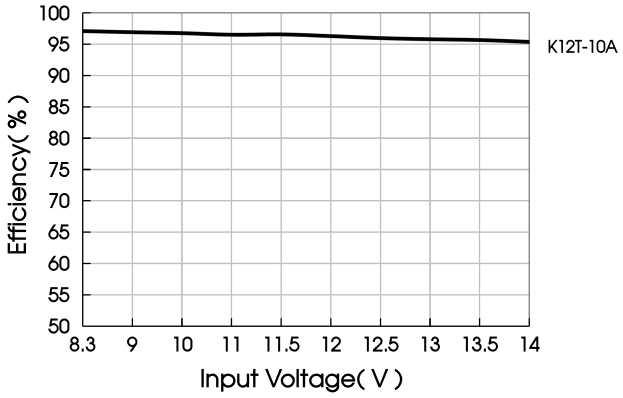
Efficiency Vs input Voltage
( Vout=0.75V, Io=10A )



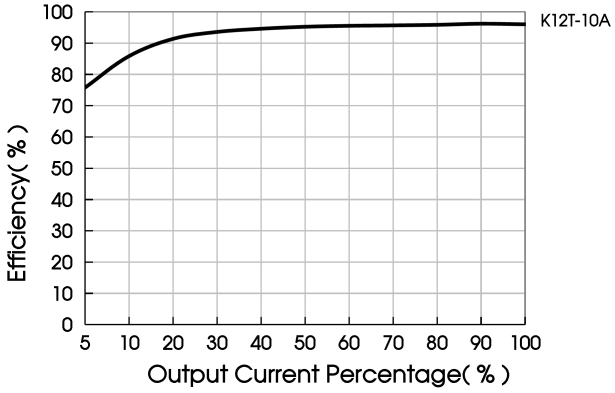

Efficiency Vs Output Load
( Vin=12V, Vout=0.75V )




Efficiency Vs input Voltage
( Vout=5V, Io=10A )

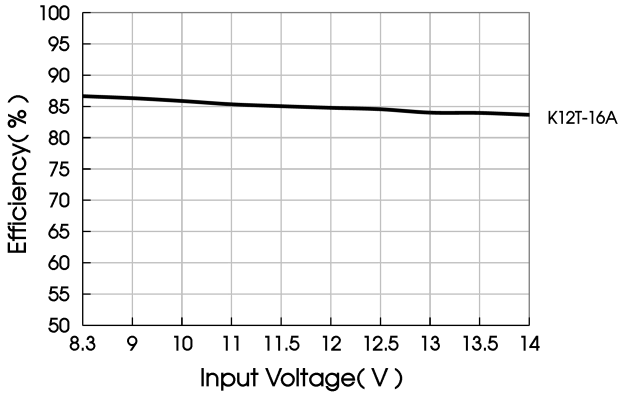



Efficiency Vs Output Load
( Vin=12V, Vout=5V )

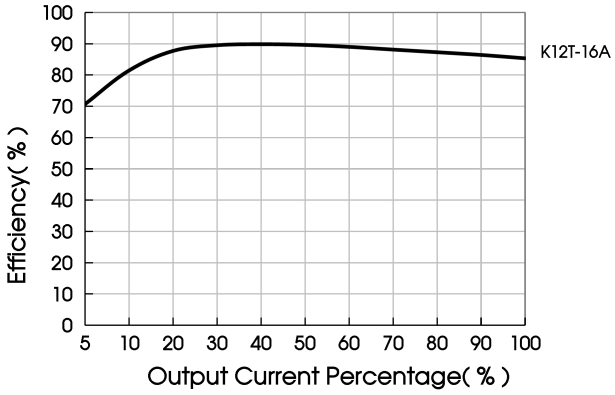


## K12T-16A Series Efficiency Curves

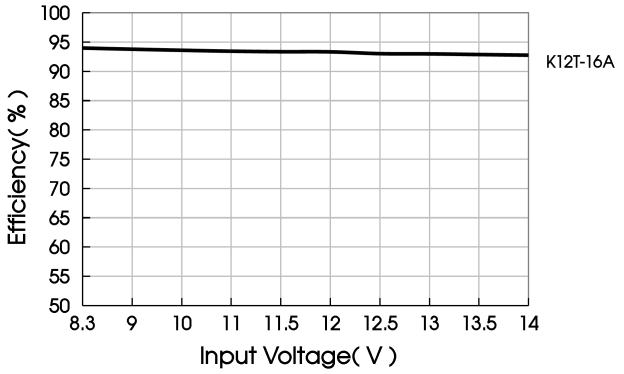
Efficiency Vs input Voltage
( Vout=1.2V, Io=16A )



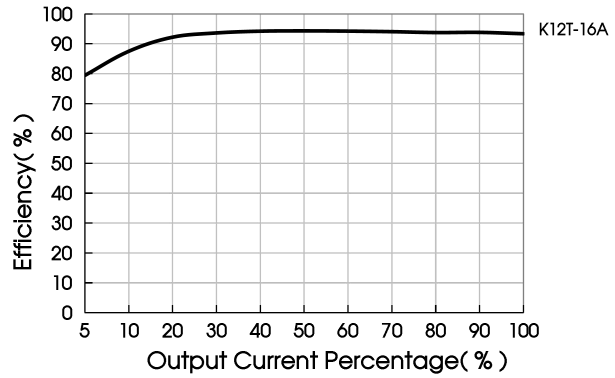

Efficiency Vs Output Load
( Vin=12V, Vout=1.2V )



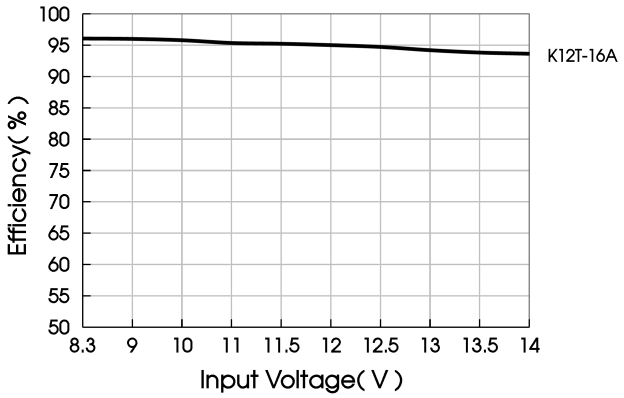

Efficiency Vs input Voltage
( Vout=3.3V, Io=16A )



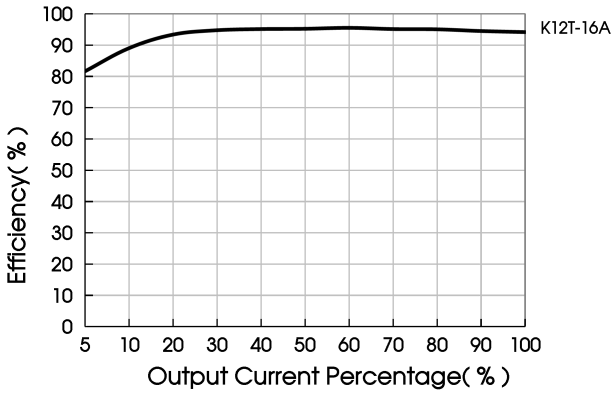

Efficiency Vs Output Load
( Vin=12V, Vout=3.3V )




Efficiency Vs input Voltage
( Vout=5V, Io=16A )

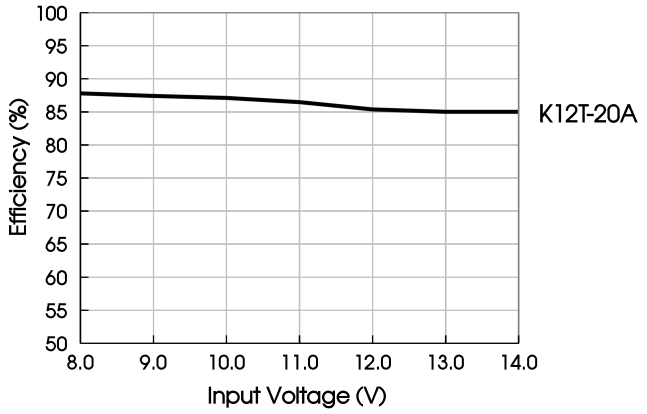



Efficiency Vs Output Load
( Vin=12V, Vout=5V )

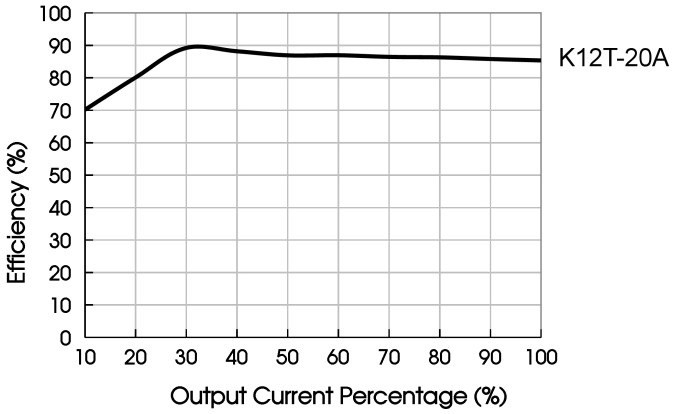


## K12T-20A Series Efficiency Curves

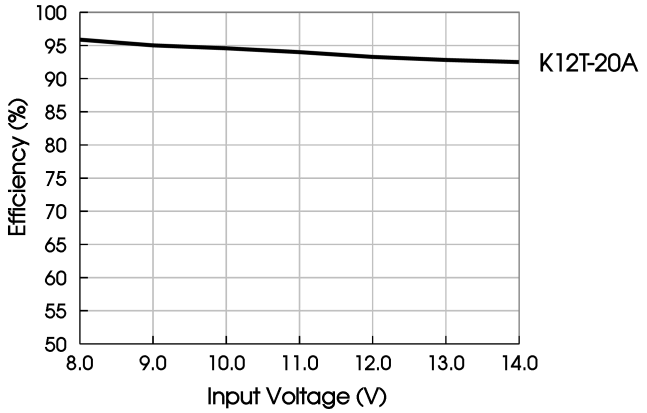
Efficiency Vs Input Voltage
(Vout=1.2V, Io=20A)



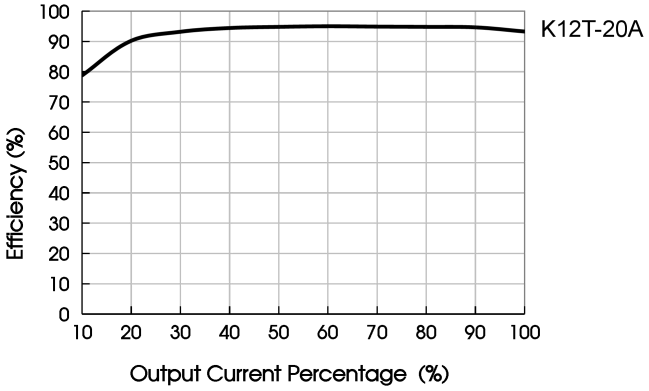

Efficiency Vs Output Load
(Vin=12V, Vout=1.2V)



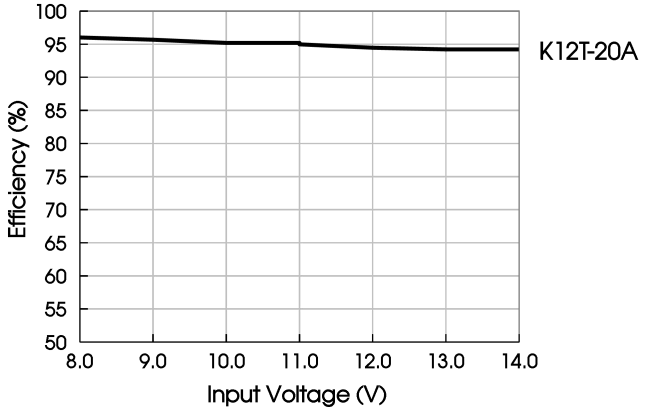

Efficiency Vs Input Voltage
(Vout=3.3V, Io=20A)



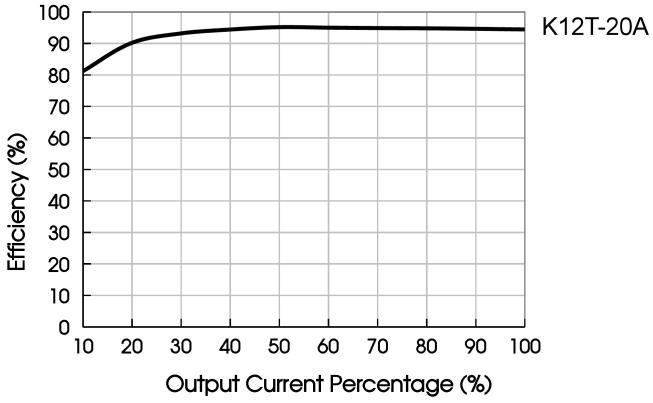

Efficiency Vs Output Load
(Vin=12V, Vout=3.3V)




Efficiency Vs Input Voltage
(Vout=5V, Io=20A)

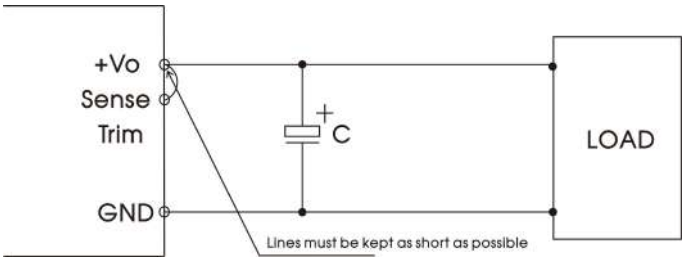



Efficiency Vs Output Load
(Vin=12V, Vout=5V)



## Remote Sense Application

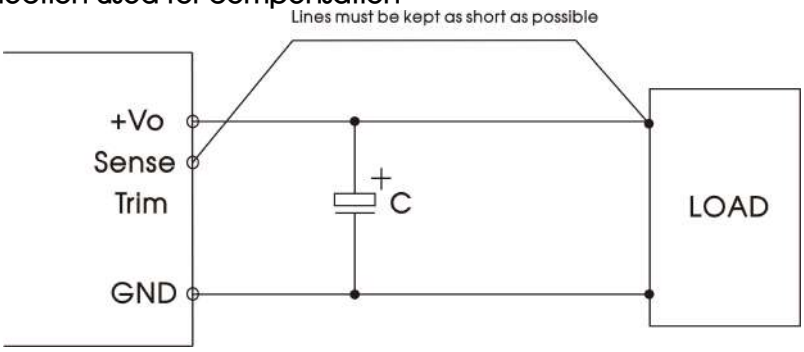
### 1. Remote sense connection if not used




Notes:

1. If the sense function is not used for remote regulation the user must connect the Sense to + Vo at the DC-DC converter pins and will compensate for voltage drop across pins only;
2. The connections between Sense and +Vo must be kept as short as possible, otherwise they may be picking up noise, interference and/or causing unstable operation of the power module.

### 2. Remote sense connection used for compensation




Notes:

1. PCB-tracks or cables/wires for Remote Sense must be kept as short as possible;
2. Using remote sense with long wires long wires may cause unstable operation. Note that large wire impedance may cause oscillation of the output voltage and/or increased ripple. Consult technical support or factory for further advice of sense operation;
3. We recommend using adequate cross section for PCB-track layout and/or cables to connect the power supply module to the load in order to keep the voltage drop below 0.3V and to make sure the power supply's output voltage remains within the specified range.

## Design Reference

### 1. Typical application

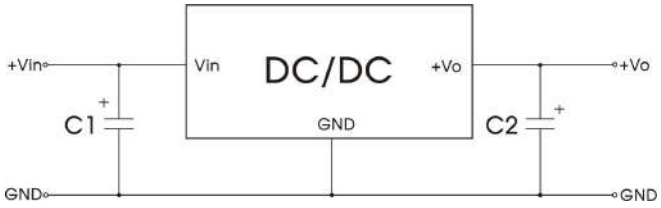



Fig. 2

Table 1

| Part No. | C1 | C2 |
|---|---|---|
| K12T-10A-P(N) | 100μF/35V | 22μF/16V |
| K12T-16A-P(N) | 220μF/35V | 47μF/16V |
| K12T-20A-P(N) | 330μF/35V | 47μF/16V |

Notes:

1. 100 μF or 220 μF capacitor (C1) and 22 μF or 47 μF capacitor (C2) are required and should be connected close to the pin terminal, to ensure the stability of the converter;
2. To reduce the output ripple further, increased values and/or tantalum or low ESR polymer capacitors may also be used instead;
3. Refer to Table 1 for C1 and C2 capacitor values; For K12T-20A product, based on Table 1, three 22uF ceramic capacitors should be used in parallel for C1 position, and two 47uF ceramic capacitors should be used in parallel for C2 position to obtain better ripple performance;
4. Converter cannot be used for hot swap and with output in parallel.

### 2. EMC compliance circuit

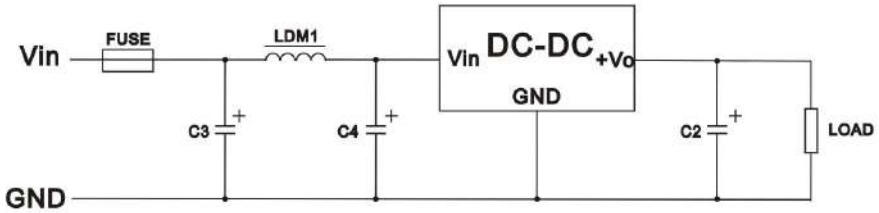



Fig. 3

Table 2

| EMI | FUSE | C3/C4 | LDM1 | C2 |
|---|---|---|---|---|
| CE | Selected based on the actual input current in application | 1000μF /35V | 6.8μH | Refer to the Cout in Table 1 |
| RE | | 100μF /35V | | |

## 3. Trim function for output voltage adjustment (open if unused)

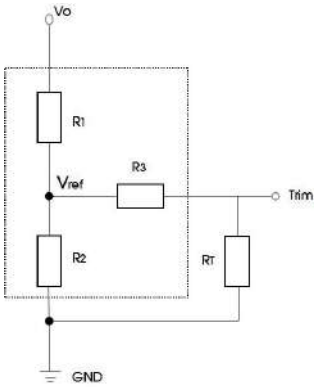



Fig. 4 Trim resistor connection (dashed line shows internal resistor network)

Table 3

| K12T-10A, K12T-16A | | K12T-20A | |
|---|---|---|---|
| Vo (VDC) | $R_T$ (kΩ) | Vo (VDC) | $R_T$ (kΩ) |
| 0.7525 | Open | 0.6 | Open |
| 1.2 | 15.089 | 1.2 | 12 |
| 1.8 | 5.873 | 1.8 | 6 |
| 2.5 | 3.120 | 2.5 | 3.789 |
| 3.3 | 1.826 | 3.3 | 2.667 |
| 5 | 0.695 | 5 | 1.636 |

Calculating Trim resistor (RT) values:

K12T-10A, K12T-16A: $$R_T(\Omega) = \frac{7200}{V_O - 0.7525} - 1000$$

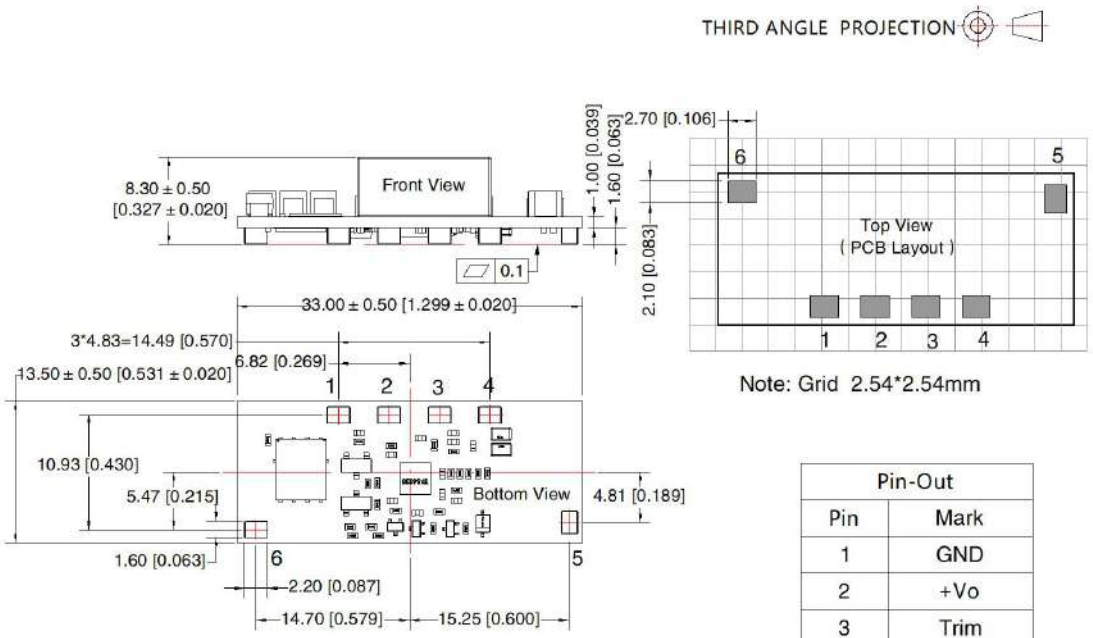
K12T-20A: $$R_T(\Omega) = \frac{7200}{V_O - 0.6}$$

Notes: 1. $R_T$: Resistance of Trim; Vo: The trim up voltage;
2. If $R_T = \infty$ or Trim pin open, Vo =0.6VDC or Vo = 0.7525 VDC.

## 4. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

## Dimensions and Recommended Layout

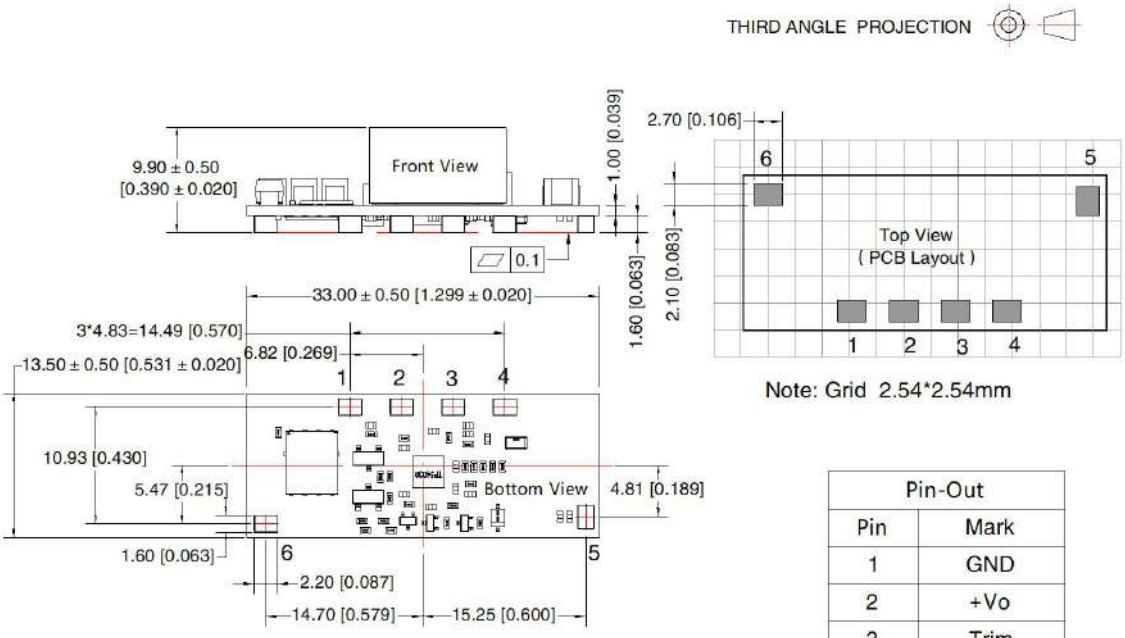
### K12T-10A,16A




| Pin-Out | |
|---|---|
| Pin | Mark |
| 1 | GND |
| 2 | +Vo |
| 3 | Trim |
| 4 | Sense |
| 5 | Ctrl |
| 6 | Vin |

Note:
Unit: mm[inch]
General tolerances: ± 0.25[ ± 0.010]
The layout of the device is for reference only, please refer to the actual product

### K12T-20A




| Pin-Out | |
|---|---|
| Pin | Mark |
| 1 | GND |
| 2 | +Vo |
| 3 | Trim |
| 4 | Sense |
| 5 | Ctrl |
| 6 | Vin |

Note:
Unit: mm[inch]
General tolerances: ± 0.25[ ± 0.010]
The layout of the device is for reference only, please refer to the actual product

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. K12T-10A, K12T-16A Packaging bag number: 58210071; K12T-20A Packaging bag number: 58210182;
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage, 5VDC output voltage and rated output load;
4. All index testing methods in this datasheet are based on company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. 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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