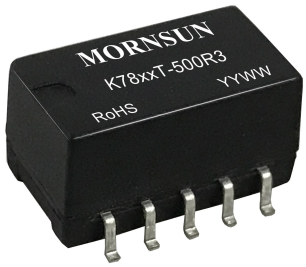
DC/DC Converter

K78_T-500R3 Series

MORNSUN®

Wide input voltage, Non-isolated and regulated single output



3 years Warranty

CE Report EN 62368-1

UKCA Report BS EN 62368-1

RoHS

FEATURES

- High efficiency up to 95%
- No-load input current as low as 0.2mA
- Operating ambient temperature range: -40℃ to +85℃
- Output short-circuit protection
- SMD package

K78_T-500R3 series are high efficiency switching regulators. The converters feature high efficiency, low loss and short circuit protection in a compact SMD package. These products are widely used in applications such as industrial control, instrumentation and electric power.

Selection Guide

Certification	Part No.	Input Voltage (VDC)*	Output		Full Load Efficiency (%) Typ.	Capacitive Load (μF)
		Nominal (Range)	Voltage (VDC)	Current (mA) Max.	Vin Min. / Vin Max.	Max.
EN/BS EN	K7801T-500R3	12 (4.75-28)	1.5	500	76/67	680
	K78X2T-500R3	12 (4.75-28)	1.8	500	76/69	680
	K7802T-500R3	12 (4.75-32)	2.5	500	81/74	680
	K7803T-500R3	24 (4.75-36)	3.3	500	86/80	680
	K7805T-500R3	24 (6.5-36)	5	500	90/84	680
	K78X6T-500R3	24 (8-36)	6.5	500	92/87	680
	K7809T-500R3	24 (12-36)	9	500	93/90	680
	K7812T-500R3	24 (15-36)	12	500	94/91	680
	K7815T-500R3	24 (19-36)	15	500	95/93	680

Note*: For input voltage exceeding 30 VDC, an input capacitor of 22uF/50V is required.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
No-load Input Current		--	0.2	1.5	mA
Reverse Polarity at Input		Avoid / Not protected			
Input Filter		Capacitance filter			
Ctrl*	Module on	Ctrl pin open or pulled high (TTL 3.2-8VDC)			
	Module off	Ctrl pin pulled low to GND (0-0.8VDC)			
	Input current when off	--	30	100	μA

Note: *The Ctrl pin voltage is referenced to input GND.

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Voltage Accuracy	Full load, input voltage range	1.5/1.8/2.5/3.3 VDC output	--	±2	±4	%
		Other output	--	±2	±3	
Linear Regulation	Full load, input voltage range		--	±0.2	±0.4	

Load Regulation	Nominal input voltage, 10% -100% load	1.5/1.8/2.5/3.3/5 VDC output	--	±0.6	--	%
		Other output	--	±0.3	--	
Ripple & Noise*	20MHz bandwidth, nominal input voltage	1.5/1.8/2.5/3.3 VDC output, 20% -100% load	--	20	50	mVp-p
		Other output, 10% -100% load	--	20	50	
Temperature Coefficient	Operating temperature -40℃ to +85℃		--	--	±0.03	%/℃
Transient Response Deviation	Nominal input voltage, 25% load step change		--	50	200	mV
Transient Recovery Time			--	0.2	1	ms
Short-circuit Protection	Nominal input voltage		Continuous, self-recovery			
Vadj	input voltage range		--	±10	--	%Vo

Note: *
1. The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information;
2. With light loads at or below 20%, Ripple & Noise for 1.5/1.8/2.5/3.3V output parts increases to 100mVp-p max. and a load below 10% for 5V/6.5V/9V/12V/15V output parts levels increase to 150mVp-p max.

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 temperature ≤245℃, duration ≤60s max. over 217℃. Also refer to IPC/JEDEC J-STD-020D.1.			
Switching Frequency	Full load, nominal input	K7801T-500R3	--	370	--	kHz
		Other output	--	700	--	
MTBF	MIL-HDBK-217F@25℃		2000	--	--	k hours
Moisture Sensitivity Level (MSL)*	IPC/JEDEC J-STD-020D.1		Level 1			

Note: * For actual application, please refer to IPC/JEDEC J-STD-020D.1.

Mechanical Specifications

Case Material	Black plastic; flame-retardant and heat-resistant (UL94V-0)
Dimensions	15.24 x11.40 x 8.25mm
Weight	1.5g (Typ.)
Cooling Method	Free air convection

Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS B (see Fig. 4-② for recommended circuit)	
	RE	CISPR32/EN55032	CLASS B (see Fig. 4-② for recommended circuit)	
Immunity	ESD	IEC/EN 61000-4-2	Contact ±4kV	perf. Criteria B
	RS	IEC/EN 61000-4-3	10V/m	perf. Criteria A
	EFT	IEC/EN 61000-4-4	±1kV (see Fig. 4-① for recommended circuit)	perf. Criteria B
	Surge	IEC/EN 61000-4-5	line to line ±1kV (see Fig. 4-① for recommended circuit)	perf. Criteria B
	CS	IEC/EN 61000-4-6	3Vr.m.s	perf. Criteria A

Typical Characteristic Curves

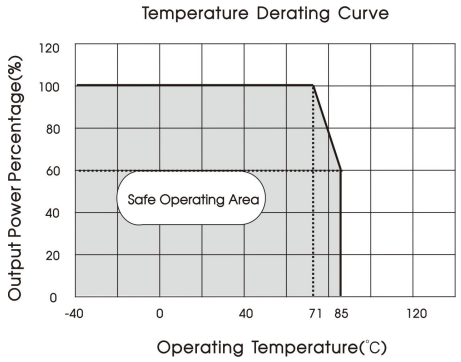
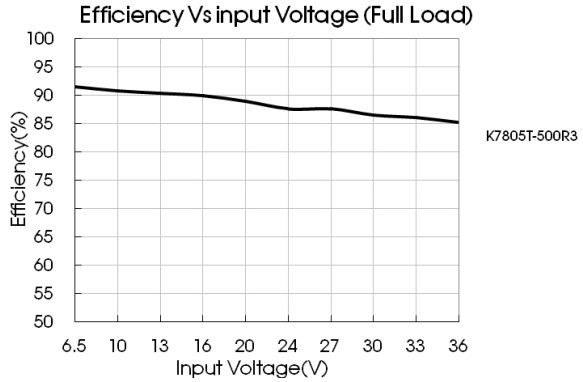
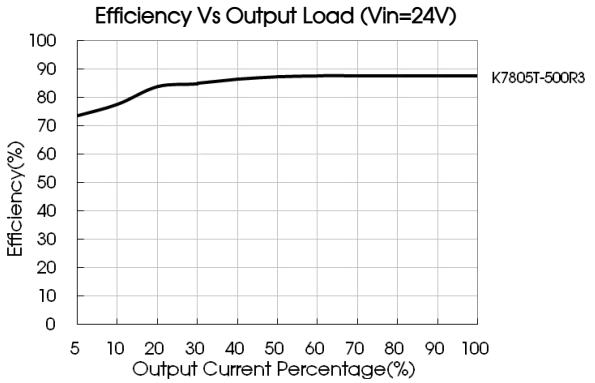
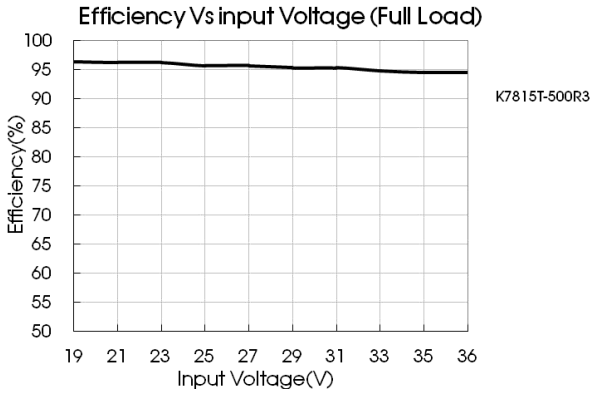
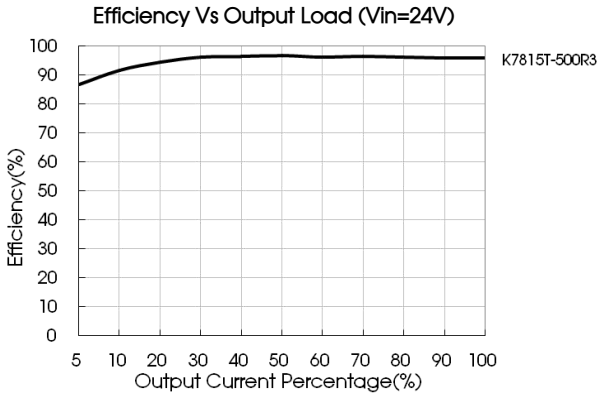


Fig. 1









Design Reference

1. Typical application

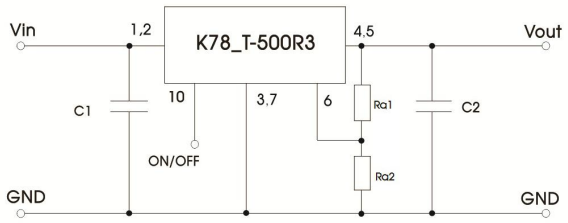


Fig. 2 Typical application circuit

Part No.	C1 (ceramic capacitor)	C2 (ceramic capacitor)	Ra1/Ra2 (Vadj resistance)
K7801T-500R3	10μF/50V	22μF/10V	Refer to Vadj resistance calculation
K78X2T-500R3		22μF/10V	
K7802T-500R3		22μF/10V	
K7803T-500R3		22μF/10V	
K7805T-500R3		22μF/16V	
K78X6T-500R3		22μF/16V	
K7809T-500R3		22μF/25V	
K7812T-500R3		22μF/25V	
K7815T-500R3		22μF/25V	

table 1

Note:
1. The required C1 and C2 capacitors must be connected as close as possible to the terminals of the module;
2. Refer to Table 1 for C1 and C2 capacitor values. For certain applications, increased values and/or tantalum or low ESR electrolytic capacitors may also be used instead;
3. Converter cannot be used for hot swap and with output in parallel;
4. To further reduce the output ripple and noise, we suggested the use of a "LC" filter at the output terminals, with an inductor value (L) of 10μH-47μH.

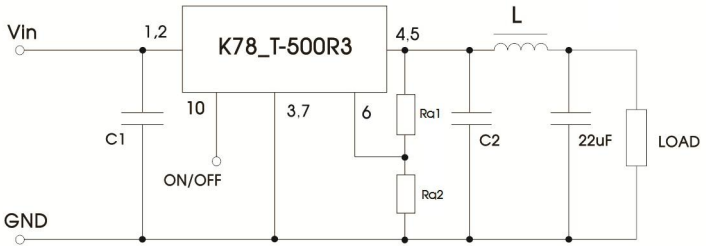


Fig. 3 External "LC" output filter circuit diagram

2. EMC Compliance circuit

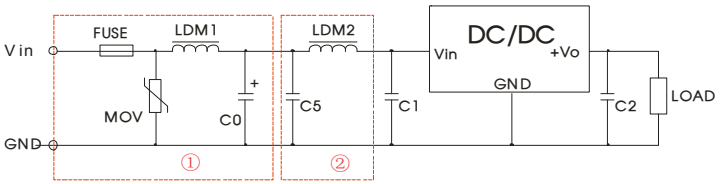


Fig.4 Recommended compliance circuit

FUSE	MOV	LDM1	C0	C1/C2	C5	LDM2
Select fuse value according to actual input current	S20K30	82μH	680μF /50V	Refer to table 1	4.7μF /50V	12μH

Note: Part ① in Fig. 4 shows Immunity compliance filter and part ② filter for Emission compliance; depending on requirement both filters ① and ② can be used in series as shown.

3. Trim Function for Output Voltage Adjustment (open if unused)

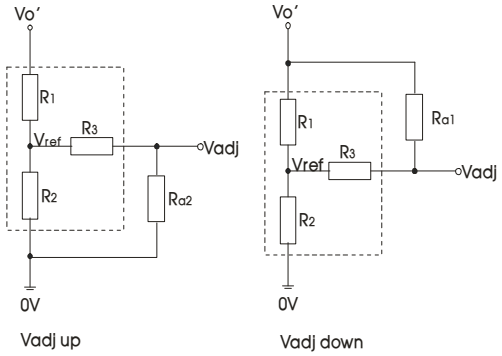


Fig. 5 Circuit diagram of Vadj up and down (dashed line shows internal part of module)

Calculating Trim resistor values:

$$\text{up: } Ra2=\frac{aR2}{R2-a}-R3 \qquad a=\frac{Vref}{Vo'-Vref}\cdot R1$$

$$\text{down: } Ra1=\frac{aR1}{R1-a}-R3 \qquad a=\frac{Vo'-Vref}{Vref}\cdot R2$$

Ra1、Ra2= Trim Resistor value;
Vo' = desired output voltage.
a = self-defined parameter;

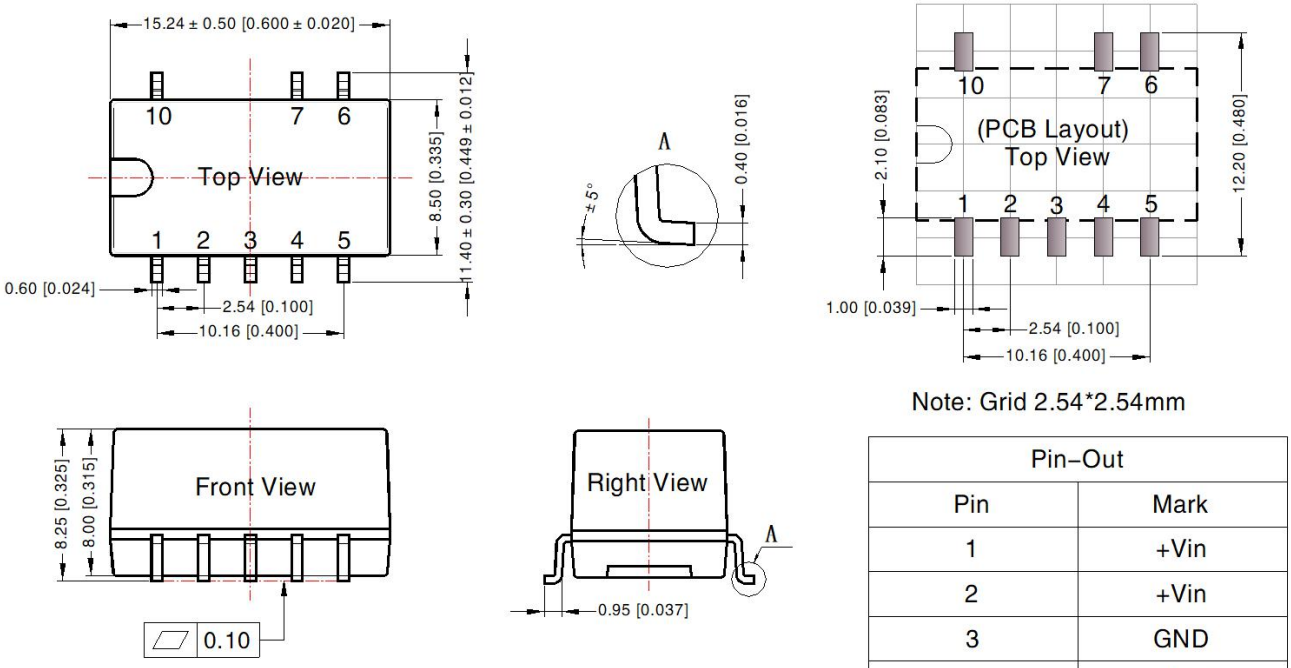
Vout(V)	R1(kΩ)	R2(kΩ)	R3(kΩ)	Vref(V)
1.5	7.5	7.5	15	0.75
1.8	35.7	26.29	100	0.765
2.5	27	11.858	51	0.765
3.3	33	9.9	47	0.765
5	75	13.5	75	0.765
6.5	75	10	51	0.765
9	51	4.7	27	0.765
12	75	5.1	27	0.765
15	82	4.423	27	0.765

Note: The 1.5V model's output voltage can only be adjusted up (Vadj up) and cannot be adjusted to a lower voltage (Vadj down is not applicable).

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

Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



Note: Grid 2.54*2.54mm

Pin–Out	
Pin	Mark
1	+Vin
2	+Vin
3	GND
4	+Vout
5	+Vout
6	V adj
7	GND
10	Remote On/Off

NC: Pin to be isolated from circuitry

Note:
Unit: mm[inch]
Pin section tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.25[± 0.010]

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Tape Packaging bag number: 58210057, Reel packaging bag number:58210058.
2. The specified maximum capacitive load is tested under full load condition and over the input voltage range;
3. All parameters in this datasheet were measured under following conditions: Ta=25℃, relative humidity <75%RH, nominal input voltage and rated output load (unless otherwise specified);
4. All index testing methods in this datatable are based on our company corporate standards;
5. The performance indexes of the product models listed in this manual are as above, but some indexes of non-standard model products will exceed the above-mentioned requirements, and please directly contact with our technician 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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