

Wide input voltage, non-isolated & regulated single output



K78_T-500R3 series are high efficiency switching regulators. The product is featured with high efficiency, low loss, short circuit protection. They are widely used in industrial control, instrumentation, and electric power applications.

FEATURES

- High efficiency up to 95%
- No-load input current as low as 0.2mA
- Operating temperature range: -40°C to +85°C
- Output short circuit protection
- SMD package
- EN62368 approval

Selection Guide

Certification	Part Number	Input Voltage (VDC)	Output		Efficiency (%/Typ.) (Min. Vin)/ (Max. Vin) @Full Load	Max. Capacitive Load(μF)
		Nominal (Range)	Output Voltage (VDC)	Max. Output Current (mA)		
CE	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 higher than 30 VDC, a 22μF/50V input capacitor is required.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
No-load Input Current		--	0.2	1.5	mA
Reverse Polarity Input		Forbidden			
Input Filter		Capacitor filter			
Remote ON/OFF*	Module switch on	suspended or connected to TTL high level (3.2-8VDC)			
	Module switch off	pin connected to GND or low level (0-0.8VDC)			
	Input current when switched off	--	30	100	μA

Note: *The voltage of Remote ON/OFF pin is relative to pin GND.

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit	
Output Voltage Accuracy	Full load, input voltage range	1.5/1.8/2.5/3.3 VDC output	--	±2	±4	%
		Others	--	±2	±3	
Line 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	--	%
		Others	--	±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
		Others, 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
Output short circuit protection	Nominal input voltage		Continuous, self-recovery			
Vadj	input voltage range		--	±10	--	%Vo

Note: *1. Ripple and noise tested with "parallel cable" method, please refer to *DC-DC Converter Application Notes* for specific operation methods;
*2. With the load lower than 20%, the maximum ripple and noise of 1.5/1.8/2.5/3.3V output products will be 100mVp-p; With the load lower than 10%, 5V/6.5V/9V/12V/15V output products will be 150mVp-p.

General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	单位	
Operating Temperature	see Fig. 1	-40	--	+85	℃	
Storage Temperature		-55	--	+125		
Storage Humidity	Non-condensing	5	--	95	%RH	
Reflow Soldering Temperature	Peak temp. ≤245℃, maximum duration time ≤60s at 217℃. For actual application, please refer to IPC/JEDEC J-STD-020D.1.					
Switching Frequency	Full load, nominal input voltage	K7801T-500R3		--	370	KHz
		Others		--	700	
MTBF	MIL-HDBK-217F@25℃	2000	--	--	K hours	

Physical Specifications

Casing Material	Black flame-retardant and heat-resistant plastic (UL94 V-0)
Package Dimensions	15.24*11.40*8.25mm
Weight	1.5g (Typ.)
Cooling Method	Free air convection

EMC Specifications

EMI	CE	CISPR32/EN55032	CLASS B (see Fig. 4-② for recommended circuit)	
	RE	CISPR32/EN55032	CLASS B (see Fig. 4-② for recommended circuit)	
EMS	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	

Product Characteristic Curve

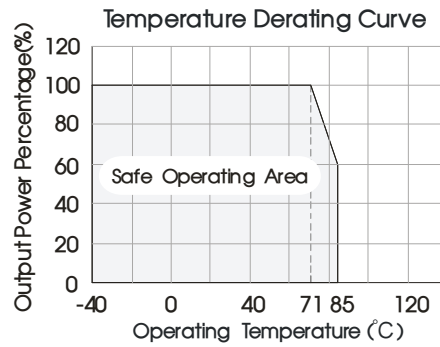
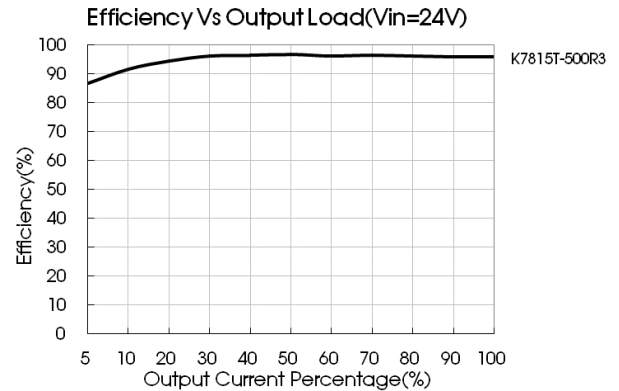
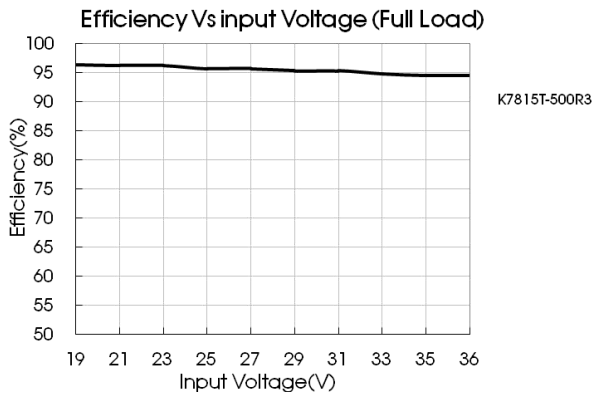
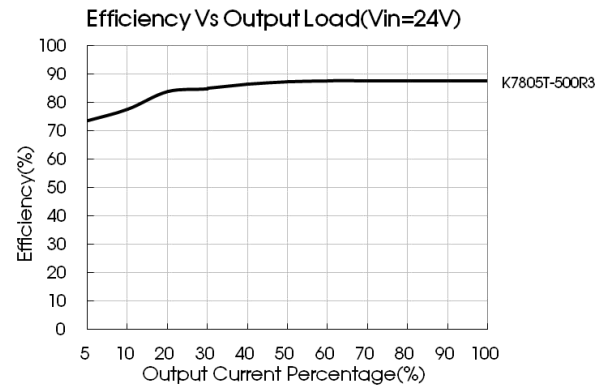
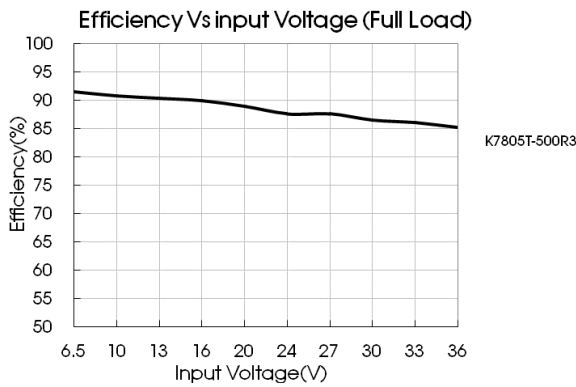


Fig. 1



Design Reference

1. Typical application circuit

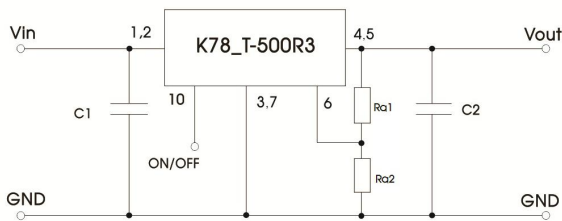


Fig. 2 Typical application circuit

Part Number	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	

Sheet 1

- Note:
1. C1 and C2 are required and should be connected close to the pin terminal of the module.
 2. The capacitance of C1 and C2 refer to Sheet 1, it can be increased properly if required, and tantalum or low ESR electrolytic capacitors may also suffice.
 3. Cannot be used in parallel for output and hot swap.

To reduce the output ripple furtherly, it is suggested to connect a "LC" filter at the output terminal, and recommended value of L is 10μH-47μH.

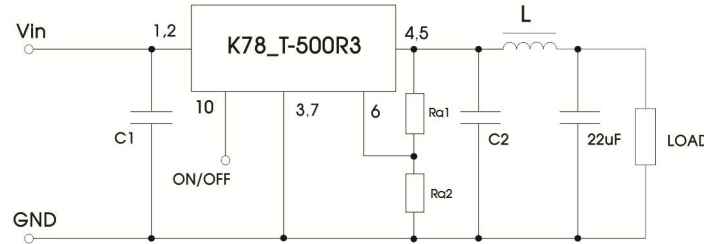


Fig. 3 "LC" filter application circuit

2. EMC solution-recommended circuit

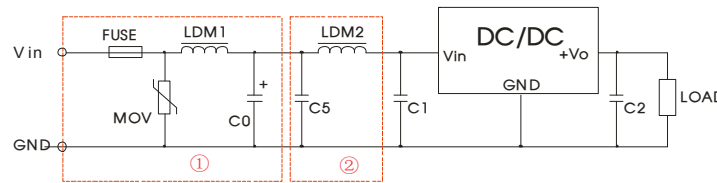


Fig.4 EMC recommended circuit

FUSE	MOV	LDM1	C0	C1/C2	C5	LDM2
Selected based on the actual input current from the customer	S20K30	82μH	680μF /50V	Refer to Sheet 1	4.7μF /50V	12μH

Note: Part ① in the Fig. 4 is for EMS test, part ② is for EMI filtering; parts ① and ② can be added based on actual requirement.

3. Application of Vadj and calculation of Vadj resistance

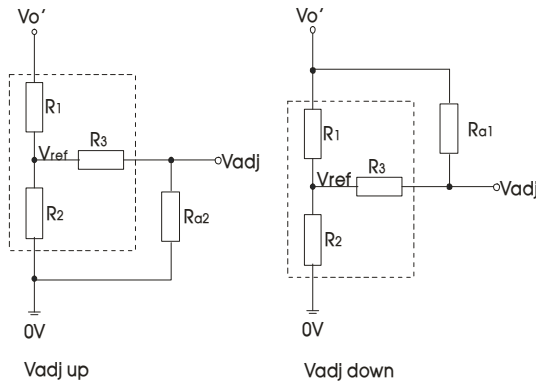


Fig.5 Applied circuits of Vadj (Part in broken line is the interior of models)

Calculation formula of Vadj resistance:

$$\begin{aligned} \text{up: } R_{a2} &= \frac{aR_2}{R_2-a} - R_3 & a &= \frac{V_{ref}}{V_{o'} - V_{ref}} \cdot R_1 \\ \text{down: } R_{a1} &= \frac{aR_1}{R_1-a} - R_3 & a &= \frac{V_{o'} - V_{ref}}{V_{ref}} \cdot R_2 \end{aligned}$$

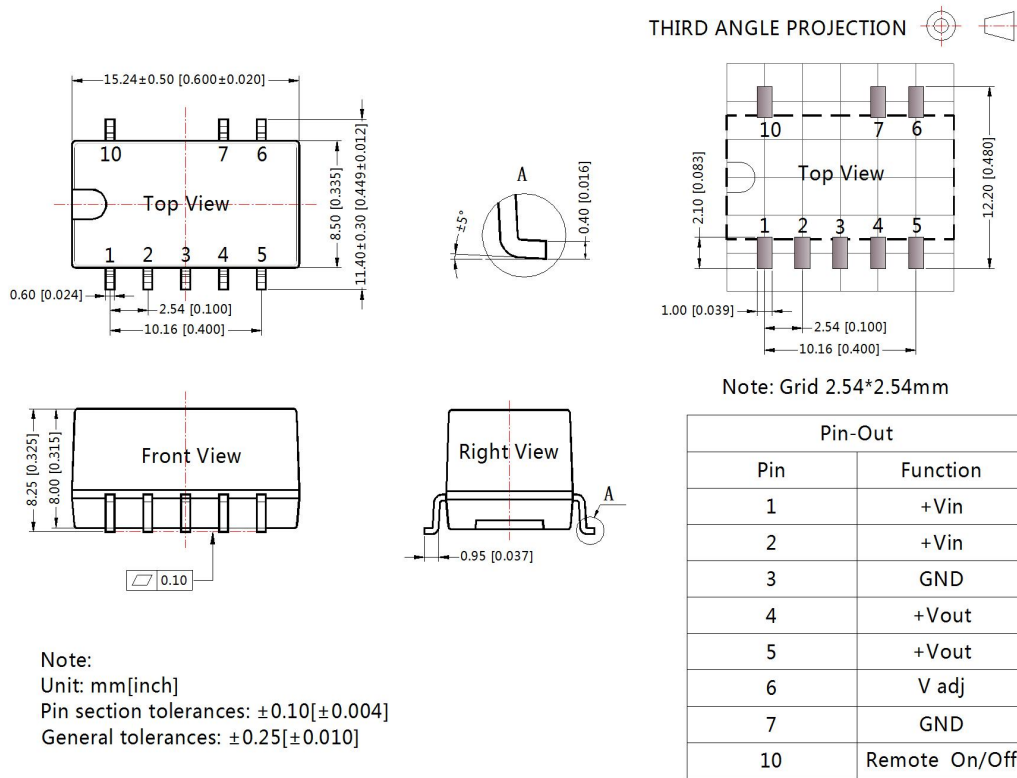
R_{a1} , R_{a2} is Vadj resistance, a is a self-defined parameter, with no real meaning. $V_{o'}$ for the actual needs of the up or down regulated voltage

Vout(V)	R1(K.Ω)	R2(K.Ω)	R3(K.Ω)	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 1.5VDC output model only support Vadj up, do not support Vadj down.

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

Dimensions and Recommended Layout



NC: Pin to be isolated from circuitry

Notes:

1. Packing information please refer to Product Packing Information which can be downloaded from www.mornsun-power.com. Tube Packing bag number: 58210057, Roll packing bag number:58210058.
2. The max. capacitive load should be tested within the input voltage range and under full load conditions;
3. Unless otherwise specified, data in this datasheet should be tested under the conditions of $T_a=25^\circ\text{C}$, humidity<75%RH when inputting nominal voltage and outputting rated load;
4. All index testing methods in this datasheet are based on our Company's 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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