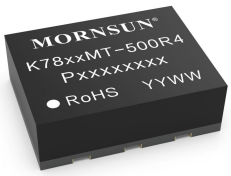
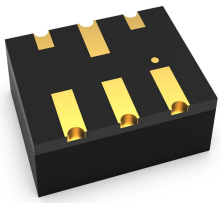
DC/DC Converter

K78_MT-500R4 Series

MORNSUN®

Wide input voltage non-isolated and regulated single output





CE Patent Protection RoHS

3 years Warranty

EN 62368-1

FEATURES

- Ultra-small, ultra-thin DFN package(9.00 x 7.00 x 3.10mm)
- Operating ambient temperature range: -40℃ to +105℃
- High efficiency up to 92%
- No-load input current as low as 0.1mA
- Output short-circuit protection
- Meets AEC-Q100

K78_MT-500R4 series are high efficiency switching regulators. The converters feature high efficiency, low loss and short-circuit protection in a compact DFN 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. Vin Min./Vin Nominal / Vin Max.	Capacitive Load (μF) Max.
		Nominal (Range)	Voltage (VDC)	Current (mA) Max.		
EN	K7803MT-500R4	24 (4.5-36)	3.3	500	89/79/71	680
		12 (7-32)	-3.3	-300	80/82/71	470
	K7805MT-500R4	24 (6.5-36)	5	500	91/83/78	680
		12 (7-31)	-5	-300	78/78/71	470
	K78X6MT-500R4	24 (8-36)	6.5	500	91/85/81	680
		12 (7-28)	-6.5	-250	80/79/73	470
	K7809MT-500R4	24 (12-36)	9	500	92/90/86	680
		12 (8-27)	-9	-200	82/82/77	470
	K7812MT-500R4	24 (15-36)	12	500	92/91/86	680
		12 (8-24)	-12	-150	81/83/79	470
	K7815MT-500R4	24 (18-36)	15	500	91/91/87	680
		12 (8-21)	-15	-150	80/81/84	470

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	Nominal input voltage	--	0.1	--	mA
Reverse Polarity at Input		Avoid / Not protected			
Input Filter		Capacitance filter			
Ctrl①	Module on	Ctrl pin open② or pulled high(TTL 2.5~5VDC)			
	Module off	Ctrl pin pulled low to GND(-Vo)(0~0.6VDC)			
	Input current when off	--	240	--	uA

Notes: ①The positive output ctrl pin voltage is referenced to input GND; Negative output ctrl pin voltage is referenced to -Vo;
②The Ctrl pin needs to be connected to +Vin pin if the electromagnetic environment with a large interference.

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Voltage Accuracy	Full load, input voltage range	3.3 VDC output	--	±2	±4	%
		Others	--	±2	±3	
Linear Regulation	Full load, input voltage range		--	±0.2	--	
Load Regulation	Nominal input voltage, 10% -100% load		--	±0.4	--	
Ripple & Noise*	20MHz bandwidth, nominal input voltage, full load		--	20	45	mVp-p
Temperature Coefficient	Operating temperature -40℃ to +105℃		--	±0.02	--	%/℃
Transient Response Deviation	Nominal input voltage, 25% load step change		--	50	120	mV
Transient Recovery Time			--	0.2	0.8	ms
Short-circuit Protection			Continuous, self-recovery			
Vtrim	Input voltage range		--	±10	--	%Vo

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
Operating Temperature	See Fig. 1	-40	--	+105	℃
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 voltage	--	2.0	--	MHz
MTBF	MIL-HDBK-217F@25℃	9152	--	--	k hours
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1	Level 3			
Pollution Degree		PD3			

Mechanical Specifications

Case Material	Black epoxy resin; flame-retardant and heat-resistant(UL94 V-0)
Dimensions	9.00 x 7.00 x 3.10mm
Weight	0.58g(Typ.)
Cooling Method	Free air convection

Electromagnetic Compatibility (EMC)

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

Note: * The static level of the Ctrl & Trim pin is ±2kV when they are not connected to external devices; It is suggested to connect an external capacitor (105k/50V) from Ctrl to GND/-Vo to meet ESD (±6kV) of the Ctrl pin, and to connect a varistor (22V/30A) from Trim to GND/-Vo to meet ESD(±6kV) of the Trim pin.

Typical Characteristic Curves

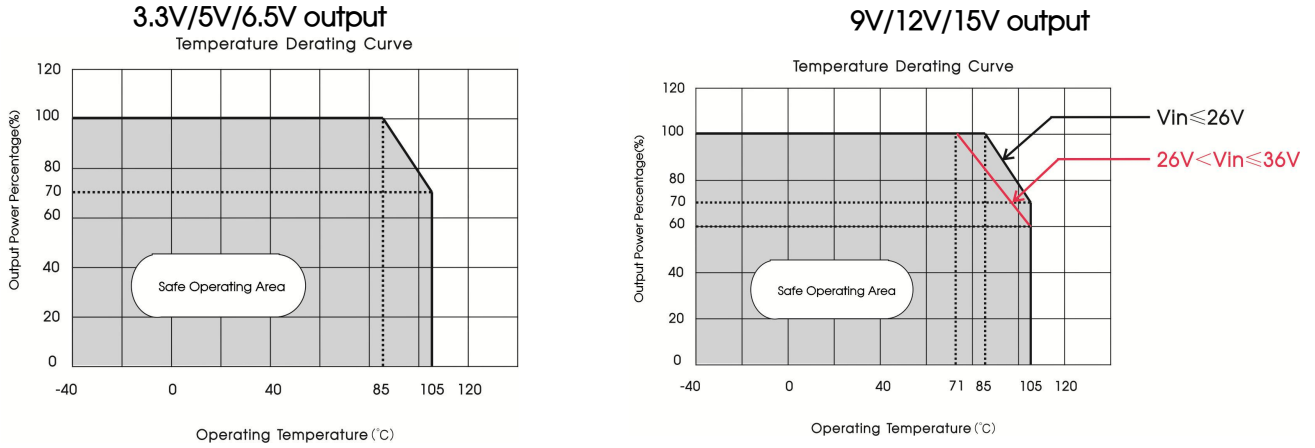
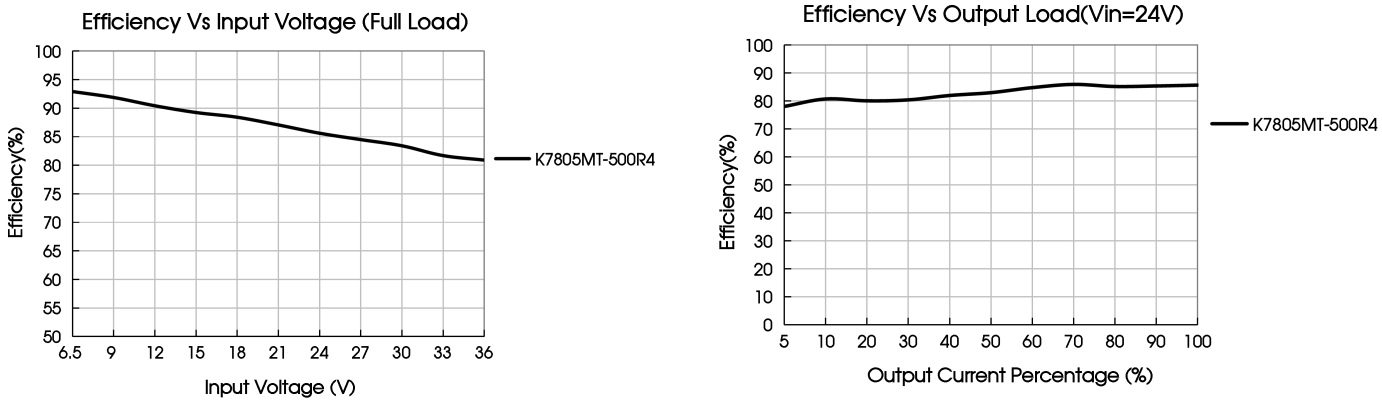


Fig. 1



Design Reference

1. Typical application

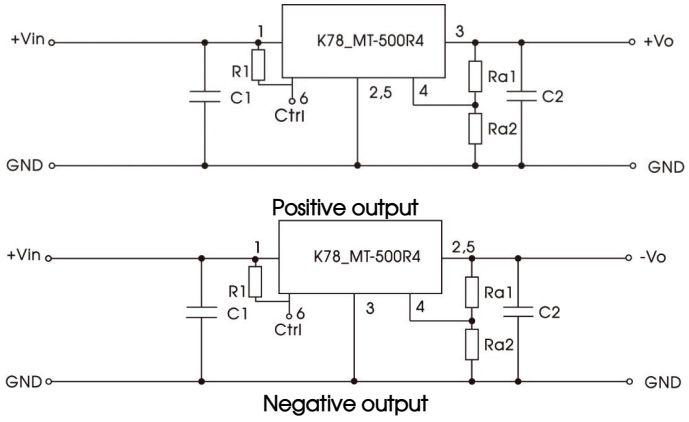


Fig. 2 Typical application circuit

Table 1

Part No.	C1 (ceramic capacitor)	C2 (ceramic capacitor)	R1
K7803MT-500R4	10μF/50V	22μF/10V	100kΩ
K7805MT-500R4		22μF/10V	
K78X6MT-500R4		22μF/16V	
K7809MT-500R4		22μF/16V	
K7812MT-500R4		22μF/25V	
K7815MT-500R4		22μF/25V	

Notes:
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. 100k is recommended for R1 when CTRL function is used. If the Ctrl function is not needed, the Ctrl pin can be shorted to the VIN pin without R1.

2. EMC compliance circuit

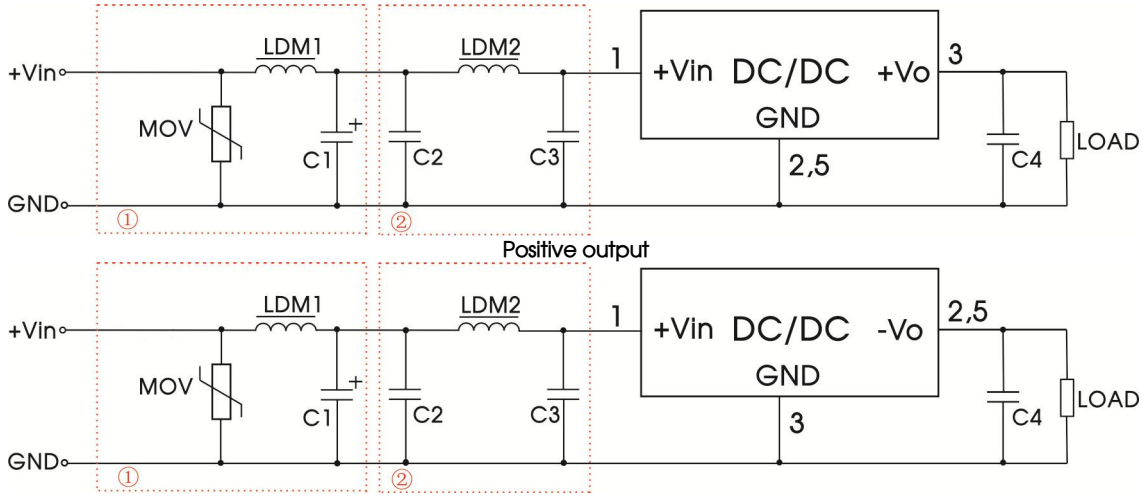


Fig.3 Recommended compliance circuit

Part No.	MOV	LDM1	C1	C2	LDM2	C3	C4
K7803MT-500R4 (Positive output)	S20K30	82μH	680μF /50V	10μF/50V	10μH	0.47μF/50V	22μF/10V
K7803MT-500R4 (Negative output)					22μH	/	
K7805MT-500R4					10μH	/	
K78X6/09MT-500R4					10μH	1μF/50V	22μF/16V
K7812/15MT-500R4					22μH	0.47μF/50V	22μF/25V

Notes: For EMC tests we use Part ① in Fig.3 for immunity and part ② for emissions test. Selecting based on needs.

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

1. Positive output application: connect trim resistor to GND/Vo respectively for adjusting up/down;
2. Negative output application: connect trim resistor to GND/-Vo respectively for adjusting up/down.

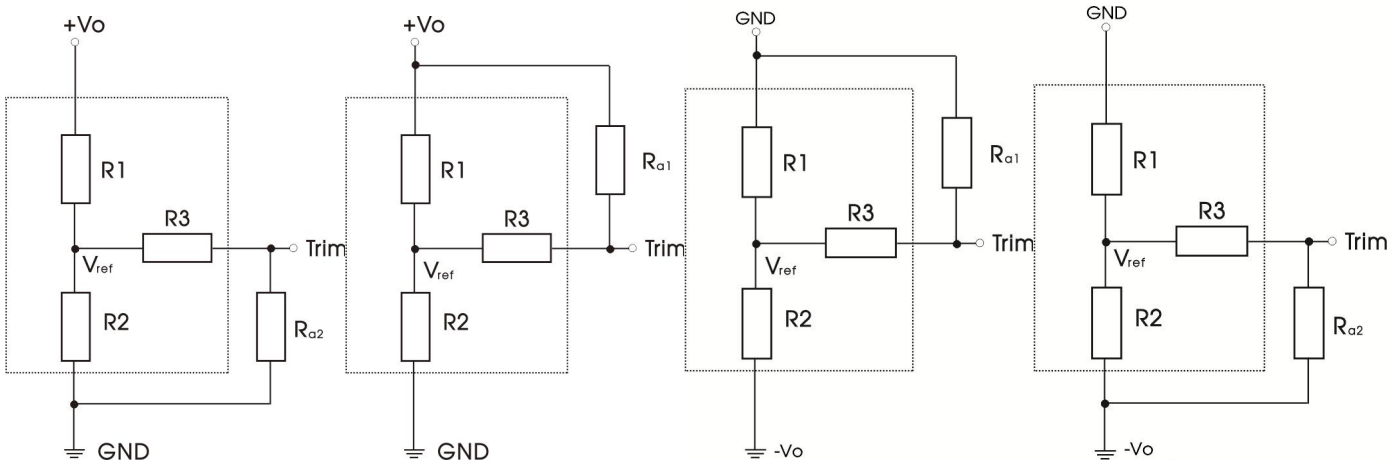


Fig. 4 Circuit diagram of Vtrim up and down (dashed line shows internal part of module)

Calculating Trim resistor values:

Trim up : $R_{a2}=\frac{aR_2}{R_2-a}-R_3,\quad a=R_2//(R_3+R_{a2})=\frac{V_{ref}}{V_o'-V_{ref}}R_1$

Trim down : $R_{a1}=\frac{aR_1}{R_1-a}-R_3,\quad a=R_1//(R_3+R_{a1})=\frac{V_o'-V_{ref}}{V_{ref}}R_2$

Vout(V)	R1(kΩ)	R2(kΩ)	R3(kΩ)	Vref(V)

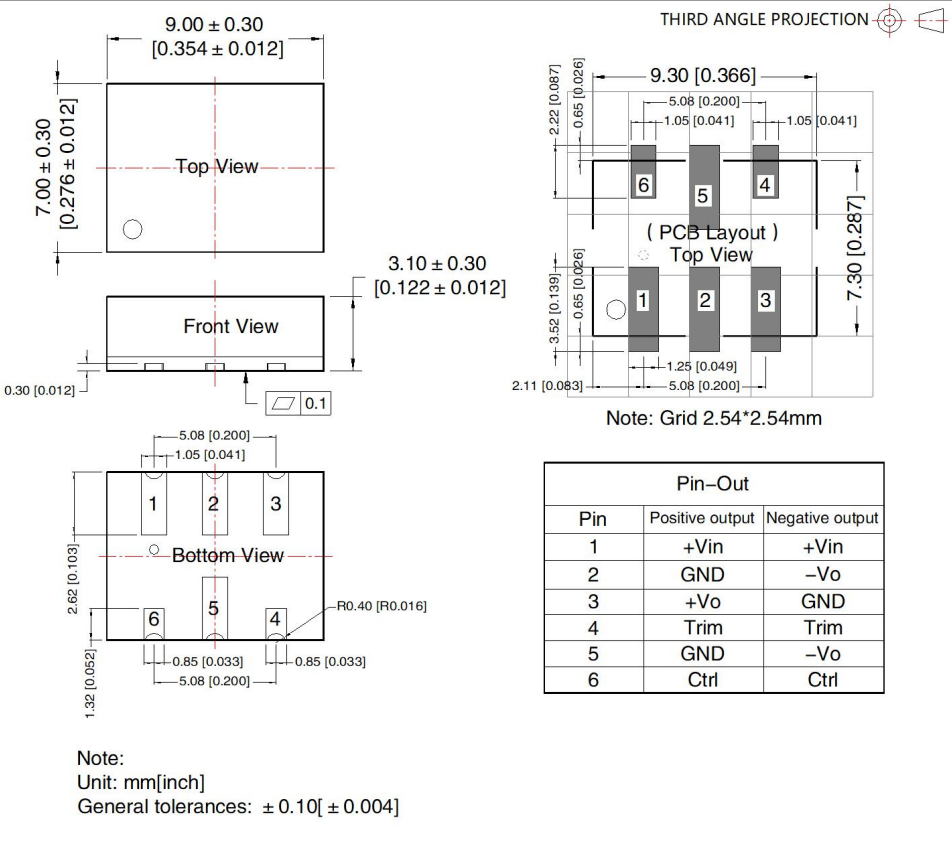
3.3	47	15	82	0.8
5	36	6.875	36	0.8
6.5	47	6.596	36	0.8
9	75	7.318	47	0.8
12	120	8.571	51	0.8
15	100	5.634	36	0.8

Table:

Vout nom.	±3.3VDC		±5.0VDC		±6.5VDC		±9.0VDC		±12VDC		±15VDC	
Vout adj.	Ra1	Ra2	Ra1	Ra2	Ra1	Ra2	Ra1	Ra2	Ra1	Ra2	Ra1	Ra2
2.97	221k											
3.63		34k										
4.5			236k									
5.5				20k								
5.85					329k							
7.15						22k						
8.1							562k					
9.9								19k				
10.8									948k			
13.2										29k		
13.5											811k	
16.5												17k

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

Dimensions and Recommended Layout

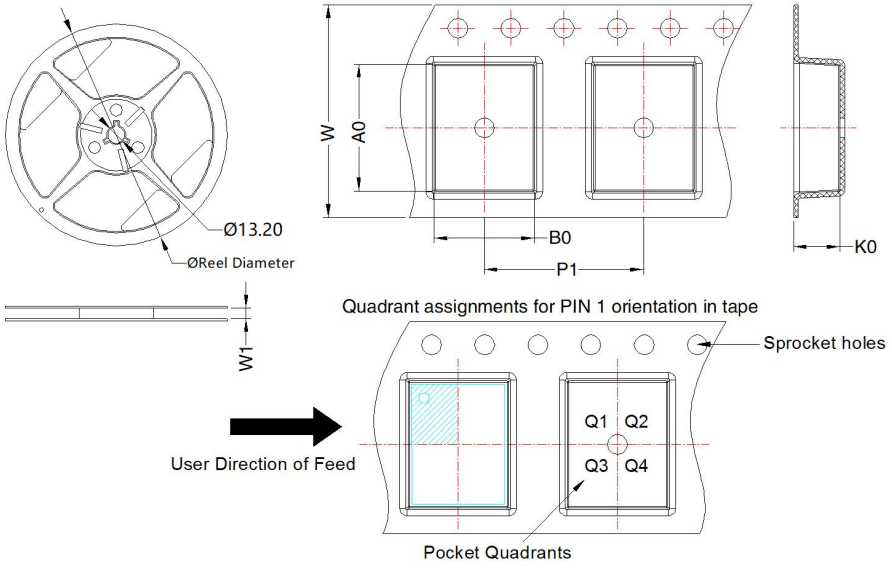


Note: Grid 2.54*2.54mm

Pin–Out		
Pin	Positive output	Negative output
1	+Vin	+Vin
2	GND	–Vo
3	+Vo	GND
4	Trim	Trim
5	GND	–Vo
6	Ctrl	Ctrl

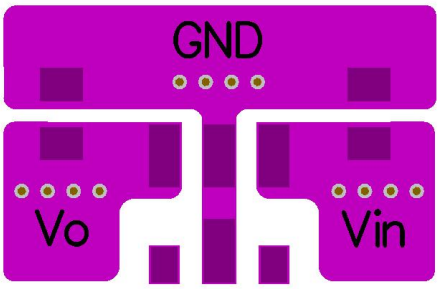
Note:
Unit: mm[inch]
General tolerances: ± 0.10[± 0.004]

Tape/Reel packaging



Device	Package Type	Pin	MPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
K78xxMT-500R4	DFN 7x9	7	400	180.0	16.4	9.56	7.56	3.5	12.0	16.0	Q1

Temperature Rise Test PCB Layout



Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Tape/Reel packaging bag number: 58240031;
2. Refer to IPC 7093 for the welding process design of this product. For detailed operation guidance, please refer to Hot Air Gun Welding Operation Instruction for DFN Package Product or Welding Operation Instruction for DFN Package Product;
3. The maximum capacitive load offered were tested at nominal input voltage and full load;
4. 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;
5. All index testing methods in this datasheet are based on our company corporate standards;
6. We can provide product customization service, please contact our technicians directly for specific information;
7. Products are related to laws and regulations: see "Features" and "EMC";
8. 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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