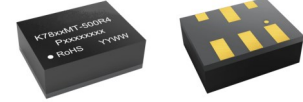


# K78\_MT-500R4 Series

- Ultra-small, ultra-thin DFN package (9 x 7 x 3.1mm)
- Operating ambient temperature range: -40°C to +105°C
- High efficiency up to 92%
- Output short-circuit protection
- Meets AEC-Q100 (under testing)
- 3 Year Warranty



The K78\_MT-500R4 series of low cost surface mount DC/DC converters offer ultra small DFN surface mount regulated current of up to 500mA in a range of voltages from +/-3.3V to +/-15V. The units operate from -40 to +105°C with a 10% trim and short circuit protection. Units are single output, but offer 2 possible voltages in one unit.

Dimensions:

9.00 x 7.00 x 3.10mm

## Models & Ratings

Model Number	Input Voltage <sup>(1)</sup>	Output Voltage	Output Current	Efficiency (Typical) Vin min/ nom / max	Maximum Capacitive Load
K7803MT-500R4	24V (4.5 - 36V)	3.3V	500mA	89/79/71%	680uF
	12V (7 - 32V)	-3.3V	-300mA	80/82/71%	470uF
K7805MT-500R4	24V (6.5 - 36V)	5V	500mA	91/83/78%	680uF
	12V (7 - 31V)	-5V	-300mA	78/78/71%	470uF
K78X6MT-500R4	24V (8 - 36V)	6.5V	500mA	91/85/81%	680uF
	12V (7 - 28V)	-6.5V	-250mA	80/79/73%	470uF
K7809MT-500R4	24V (12 - 36V)	9V	500mA	91/90/86%	680uF
	12V (8 - 27V)	-9V	-200mA	82/82/77%	470uF
K7812MT-500R4	24V (15 - 36V)	12V	500mA	92/91/86%	680uF
	12V (8 - 24V)	-12V	-150mA	81/83/79%	470uF
K7815MT-500R4	24V (18 - 36V)	15	500mA	91/91/87%	680uF
	12V (8 - 21V)	-15V	-150mA	80/81/84%	470uF

## Notes

1. For Vin above >30VDC use 22uF/50V
2. Max capacitive load tested at nominal Vin and max load
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25°C, humidity<75%RH with nominal input voltage and rated output load.

## Input

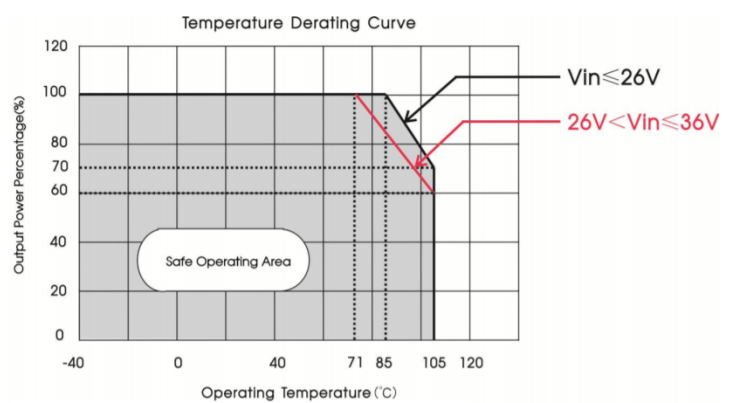
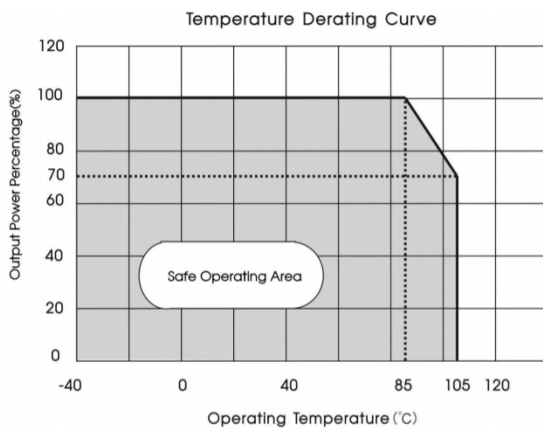
Parameter	Condition	Minimum	Typical	Maximum	Unit
No load input current	Nominal input voltage	-	0.1	-	mA
Input filter		Capacitor			
Control <sup>(1)</sup>	Module on	Ctrl pin open <sup>(2)</sup> or pulled high (TTL 2.5~5VDC)			
	Module off	Ctrl pin pulled low to GND(-Vo)(0~0.6VDC)			
	Input current when off	-	240	-	uA

## Notes

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

## General

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Switching frequency		2		MHz	
MTBF	9152			kHrs	As per MIL-HDBK-217F, 25°C GB
Weight	0.58g typical				
Case material	Back epoxy resin: flame-retardant and heat resistant (UL94 V-0)				
Pollution Degree	PD3				
Reflow Soldering Temperature	Peak temperature <245°C, duration <60s max over 217°C.also refer IPC/ JEDEC J-STD-020D.1.				

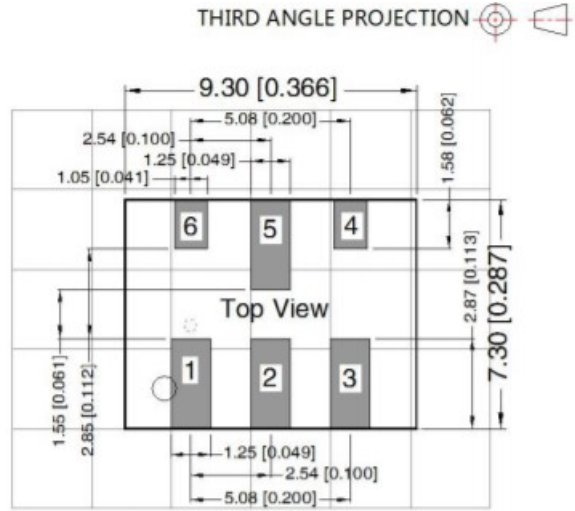
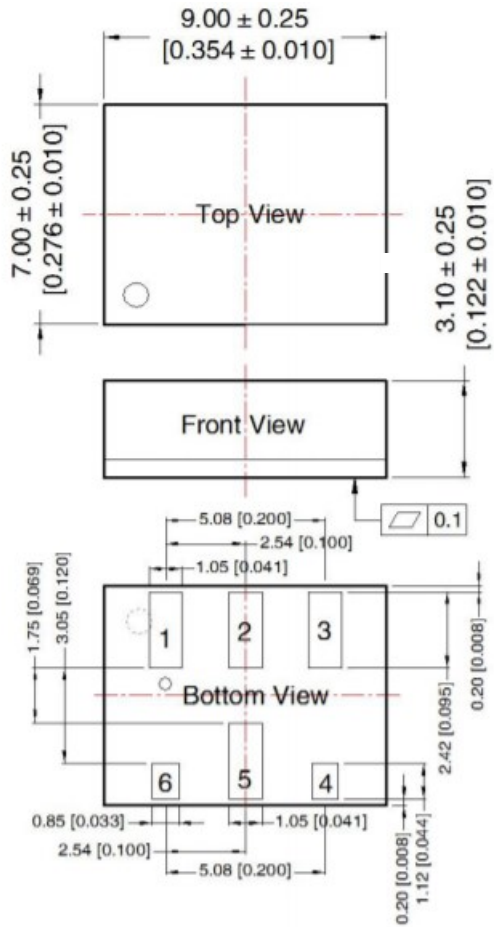


Environmental					
Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating temperature	-40		105	°C	See derating curve
Storage temperature	-55		125	°C	
Cooling					Convection cooled 30-65LFM
Humidity	5		95	% RH	Non-condensing
Moisture sensitivity level (MSL)	IPC/JEDEC J-STD-020D.1 LEVEL 1				

Output					
Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Set point accuracy: 3.3V Others	-	±2	±4	%	Full load
	-	±2	±3		
Line regulation	-	±0.2	-		
Load regulation	-	±0.4	-		From 10% to 100% load change. Nominal Vin
Temperature coefficient	-	±0.02	-	%/°C	Operating temp -40°C to 105°C
Ripple and noise		20	45	mVp-p	20MHz BW
Transient response deviation	-	50	120	mV	Nominal input voltage, 25% step change
Transient recovery time	-	0.2	0.8	ms	
Short circuit protection	Continuous, self-recovery				
Vtrim	-	±10	-	%Vout	Input voltage range

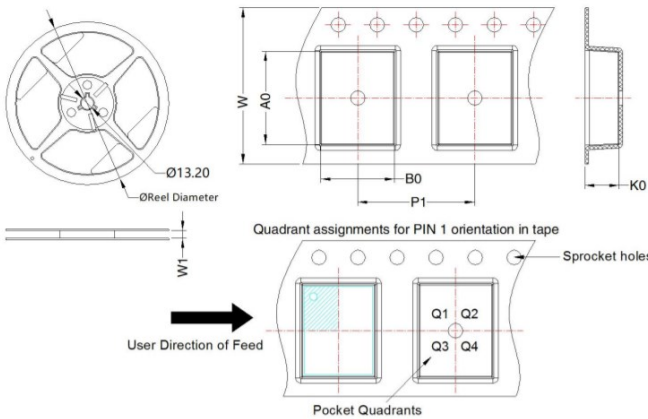
EMC			
	Standard	Criteria	Notes & Conditions
Conducted	CISPR32 / EN55032 level B	-	See application note
Radiated	CISPR32 / EN55032 Level B	-	See application note
ESD	IEC 61000-4-2	B	6kV contact discharge. 2kV on Ctrl. If higher level required on Ctrl contact sales
RS	IEC 61000-4-3	A	80~1000 MHz, 10V/m, 80% AM (1kHz)
CS	IEC 61000-4-6	A	3Vrms
EFT	IEC 61000-4-4	B	1kV. See application note
Surge	IEC 61000-4-5	B	1kV. See application note

## Mechanical Details



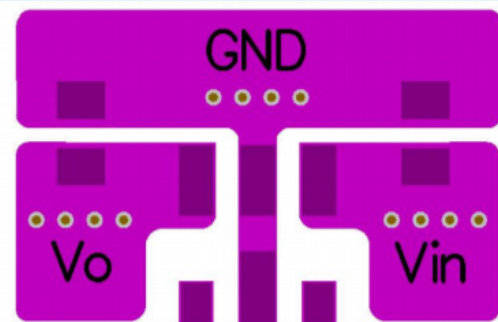
Note: Grid 2.54\*2.54mm

Pin Connections		
Pin	Positive	Negative
1	+Vin	+Vin
2	GND	-Vout
3	+Vout	GND
4	Trim	Trim
5	GND	-Vout
6	Ctrl	Ctrl



Device	Package Type	Pin	MPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
K78xMT-500R4	DFN 7x9	7	400	180.0	16.4	9.56	7.56	3.5	12.0	16.0	Q1

Pad Layout



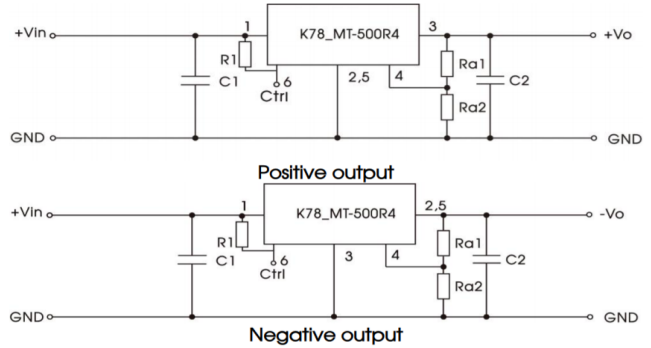
### Notes

- All dimensions shown in millimetres [inches]
- Pin tolerance  $\pm 0.10$  [ $\pm 0.004$ ]
- Please contact us for soldering process details

## Application note

### Typical application

Additional components are recommended for best performance. They should be placed as close to the module as possible. Note that capacitor values may be increased to enhance performance or used in addition with tantalum or low ESR electrolytics.



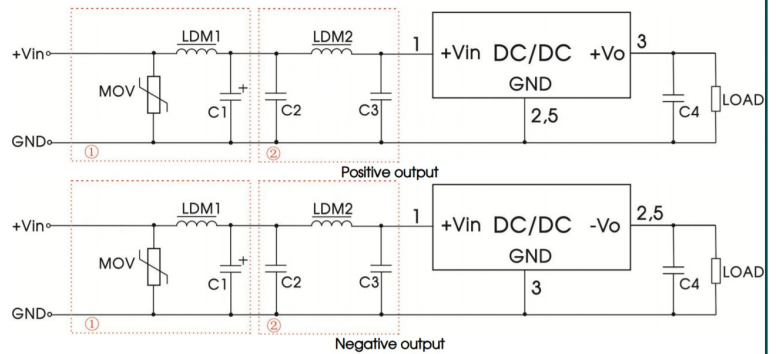
If control function is used it is recommended that R1 be used else the control pin can be shorted

Model Number	C1	C2	R1
K7803MT-500R4	10pF	22uF/10V	100KΩ
K7805MT-500R4		22uF/10V	
K78X6MT-500R4		22uF/16V	
K7809MT-500R4		22uF/16V	
K7812MT-500R4		22uF/25V	
K7815MT-500R4		22uF/25V	

### EMI Filter

Additional components should be used to enhance EMI performance. Components should be placed as close to the unit as possible.

Section 1 of the filter is used to mitigate surge and transients. Section 2 of the filter is for mitigating emissions

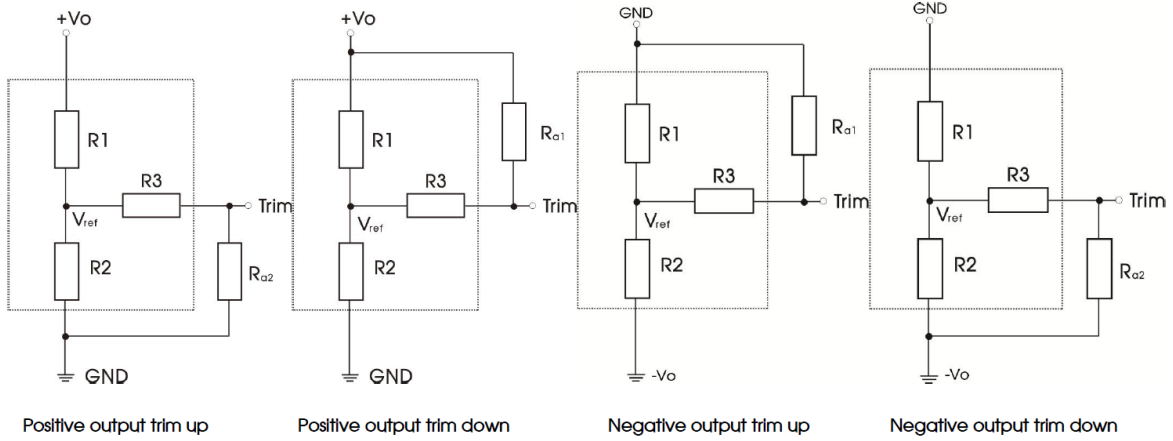


Model Number	MOV	LDM1	C1	C2	LDM2	C3	C4
K7803MT-500R4 (Positive output)	S20K30	82uH	680uF/50V	10uF/50V	10uH	0.47uF/50V	22uF/10V
K7803MT-500R4 (Negative output)					22uH	-	
K7805MT-500R4					10uH	-	22uF/16V
K78X6/09MT-500R4					10uH	1uF/50V	
K7812/15MT-500R4					22uH	0.47uF/50V	

## Application note

### Trim

The output voltage can be trimmed by adding the appropriate resistor to the pins shown below



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

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

Vout	R1(kΩ)	R2(kΩ)	R3(kΩ)	Vref
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	8.517	51	0.8
15	100	5.634	36	0.8

Vout nom	±3.3VDC		±5VDC		±6.5VDC		±9VDC		±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