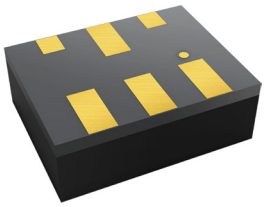
Non Isolated Board Mount DC / DC Converters

Wide input voltage non-isolated and regulated single

RoHS Compliant



Features

- Ultra-small, ultra-thin DFN package(9mm × 7mm × 3mm)
- Operating ambient temperature range: -40°C to +105°C
- High efficiency up to 94%
- No-load input current as low as 0.1mA
- Continuous short circuit protection
- Meets EN62368
- Meets AEC-Q100 (under testing)
- No heat sink required
- 1.0A DFN package
- Short circuit protection
- Low ripple and noise
- MTBF: 8552k hours (Mil-HDBK-217F @ 25°C)
- 3 Years Warranty

Description

The MP-K78-1000R4 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

Part Number	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.		
MP-K7803MT-1000R4	24 (4.75-36)	3.3	1000	89/84/81	680
	12 (8-27)	-3.3	-500	85/85/81	330
MP-K7805MT-1000R4	24 (6.5-36)	5	1000	92/87/84	680
	12 (8-27)	-5	-500	85/85/83	330
MP-K7812MT-1000R4	24 (15-36)	12	1000	94/91/89	680
	12 (8-20)	-12	-300	83/85/84	330

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			
Ctrl*	Module on	Ctrl pin open or pulled high(TTL 1.6V DC to 5V DC)			
	Module off	Ctrl pin pulled low to GND(-Vo)(0V DC to 0.6V DC)			
	Nominal input voltage, input current when off	--	240	--	uA

Note: *The positive output ctrl pin voltage is referenced to input GND; Negative output ctrl pin voltage is referenced to -Vo.

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Voltage Accuracy	Full load, input voltage range	3.3 VDC output	--	±2	±4	%
		Others	--		±3	
Linear Regulation	Full load, input voltage range		--	±0.2	--	
Load Regulation	Nominal input voltage, 10% -100% load		--	±1		
Ripple & Noise*	20MHz bandwidth, nominal input voltage, full load		--	75	150	mVp-p
	20MHz bandwidth, nominal input voltage, full load, external capacitor 22μF		--	20	75	
Temperature Coefficient	Operating temperature -40°C to +105°C		--	±0.02	--	%/°C
Transient Response Deviation	Nominal input voltage, 25% load step change	3.3 V/5V/6.5V/9VDC output	--	50	150	mV
		12V/15VDC output	--	100	300	
Transient Recovery Time	Nominal input voltage, 25% load step change			0.1	0.8	ms
Short-circuit Protection			Continuous, self-recovery			
Trim	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	°C
Storage Temperature		-55	--	+125	
Storage Humidity	Non-condensing	5	--	95	%RH
Reflow Soldering Temperature		Peak temperature ≤245°C, duration ≤60s max. over 217°C. Also refer to IPC/JEDEC J-STD-020D.1.			
Switching Frequency	Full load, nominal input voltage	--	1	--	MHz
MTBF	MIL-HDBK-217F@25°C	8552	--	--	K hours
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1	Level 3			
Pollution Degree		PD3			

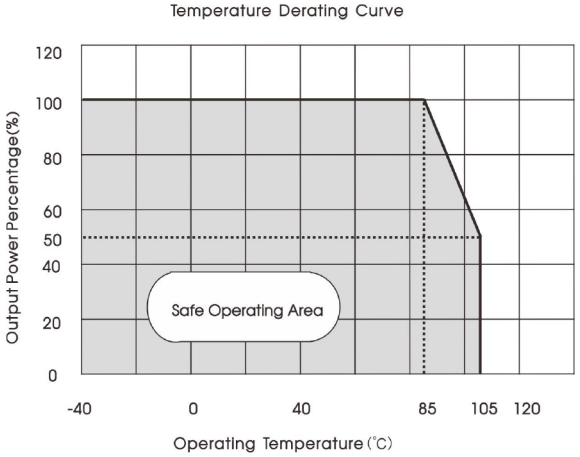
Mechanical Specifications

Case Material	Black epoxy resin; flame-retardant and heat-resistant(UL94 V-0)
Dimensions	9mm × 7mm × 3.1mm
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

Typical Characteristic Curves

3.3V/5V/6.5V output



9/12/15V output

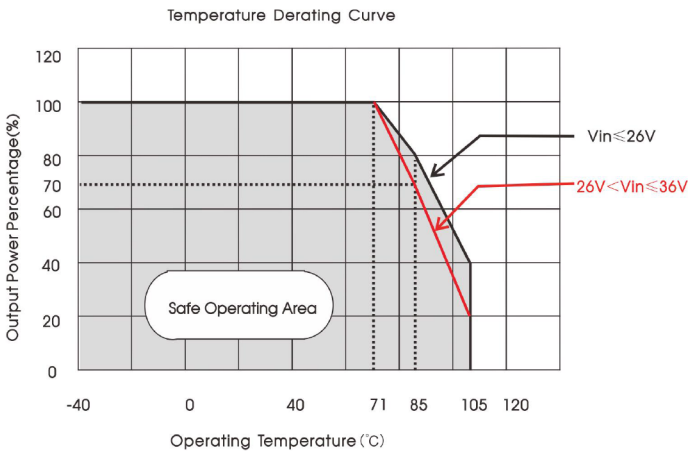


Fig. 1

Design Reference

1. Typical application

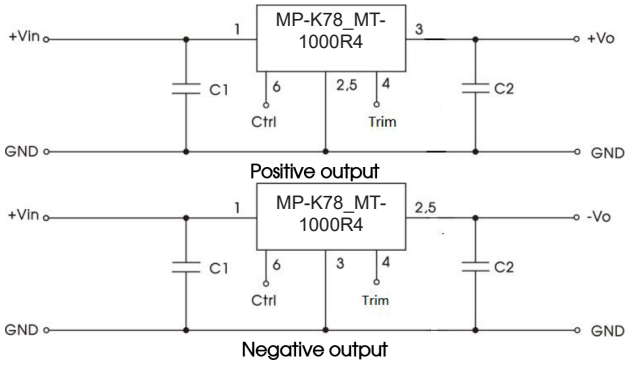


Fig. 2 Typical application circuit

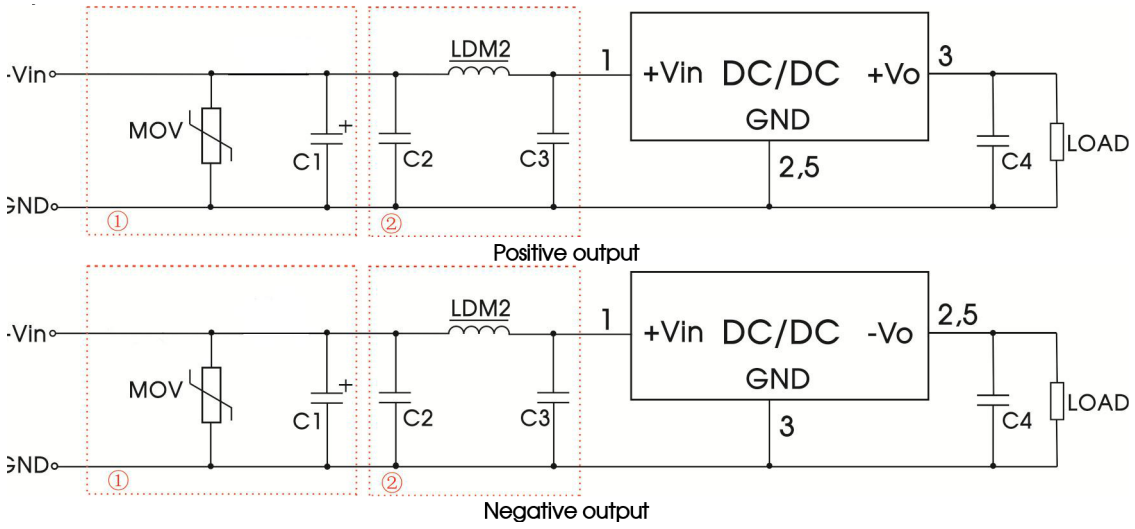
Table 1

Part Number	C1 (ceramic	C2 (ceramic capacitor)	Ra1/Ra2 (Trim resistance))
MP-K7803MT-1000R4	10μF/50V	22μF/10V	Refer to Trim resistance calculation
MP-K7805MT-1000R4			
MP-K7812MT-1000R4		22μF/25V	

Notes:
Negative output
Fig. 2 Typical application circuit
Table 1

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.

2. EMC compliance circuit



Part No.	MOV	C1	C2	LDM2	C3	C4
K7803/05/X6MT-10 00R4 (Positive output)	S20K30	680μF /50V	10μF/50V	68μH	--	22μF/25V
Others	S20K30	680μF /50V	10μF/50V	68μH	10μF/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

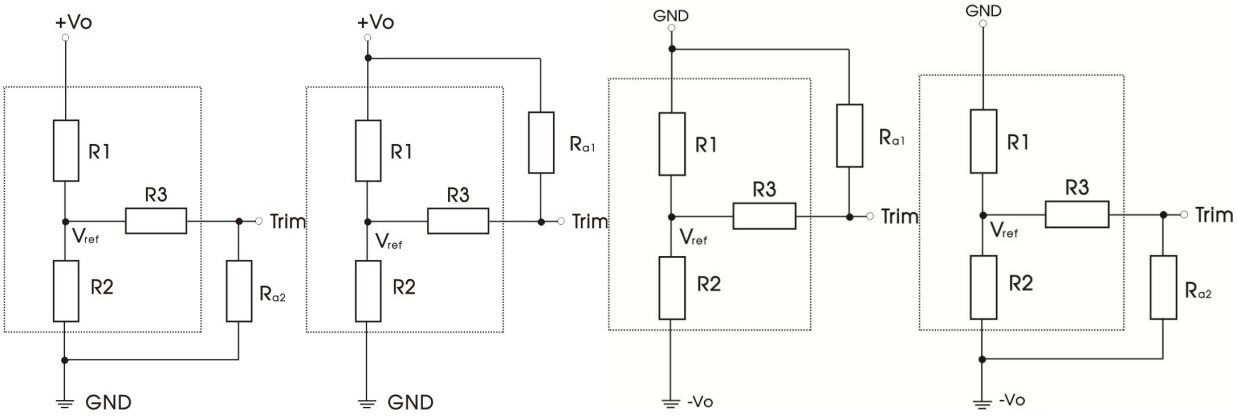


Fig.4 Circuit diagram of Trim up and down (dashed line shows internal part of module)

Calculating Trim resistor values:

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

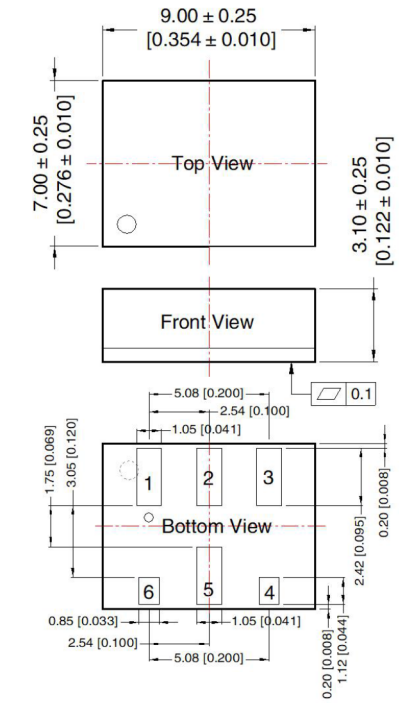
Trim down : $R_{a1}=\frac{aR_1}{R_1-a}-R_3,\quad a=R_1//(R_3+R_{a1})=\frac{V_o'-V_{ref}}{V_{ref}}R_2$

Vout(V)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
3.3	150	33	180	0.6
5	100	13.66	82	0.6
6.5	32.4	3.3	20	0.6
9	100	7.14	47	0.6
12	100	5.28	43	0.6
15	180	7.5	51	0.6

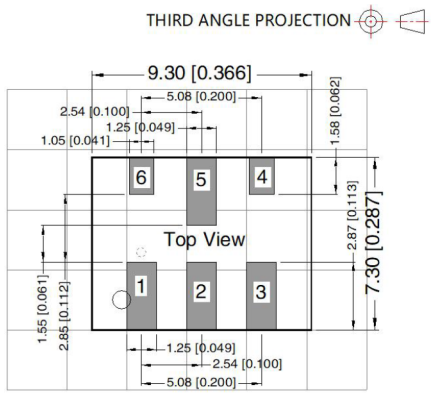
Dimensions and Recommended Layout

Vout nom.	±3.3VDC		±5.0VDC		±6.5VDC		±9.0VDC		±12VDC		±15VDC	
Vout Trim.	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)	Ra1 (KΩ)	Ra2 (KΩ)
2.97	815	-	-	-	-	-	-	-	-	-	-	-
3.63	-	117.3	-	-	-	-	-	-	-	-	-	-
4.5	-	-	710	-	-	-	-	-	-	-	-	-
5.5	-	-	-	36.2	-	-	-	-	-	-	-	-
5.85	-	-	-		245.4	-	-	-	-	-	-	-
7.15	-	-	-	-	-	9.5	-	-	-	-	-	-
8.1	-	-	-	-	-	-	783.2	-	-	-	-	-
9.9	-	-	-	-	-	-	-	19.9	-	-	-	-
10.8	-	-	-	-	-	-	-	-	382.2	-	-	-
13.2	-	-	-	-	-	-	-	-	-	5.5	-	-
13.5	-	-	-	-	-	-	-	-	-	-	509.6	-
16.5	-	-	-	-	-	-	-	-	-	-	-	21

Dimensions and Recommended Layout



Note:
Unit :mm[inch]
Pin diameter tolerances : ± 0.10[± 0.004]



Note: Grid 2.54*2.54mm

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