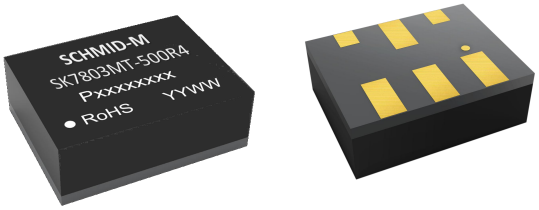
DC/DC Converter

SK78_MT-500R4 Series

Wide input voltage non-isolated and regulated single output



3 years Warranty

Patent Protection RoHS

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
- AEC Q100 approved (under testing)

SK78_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.		
--	SK7803MT-500R4	24 (4.5-36)	3.3	500	89/79/71	680
		12 (7-32)	-3.3	-300	80/82/71	470
	SK7805MT-500R4	24 (6.5-36)	5	500	91/83/78	680
		12 (7-31)	-5	-300	78/78/71	470
	SK78X6MT-500R4	24 (8-36)	6.5	500	91/85/81	680
		12 (7-28)	-6.5	-250	80/79/73	470
	SK7809MT-500R4	24 (12-36)	9	500	92/90/86	680
		12 (8-27)	-9	-200	82/82/77	470
	SK7812MT-500R4	24 (15-36)	12	500	92/91/86	680
		12 (8-24)	-12	-150	81/83/79	470
	SK7815MT-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			
Ctrl*	Module on	Ctrl pin open 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

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	--	±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			
Vadj	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 ×7.00 × 3.10mm
Weight	0.58g(Typ.)
Cooling Method	Free air convection

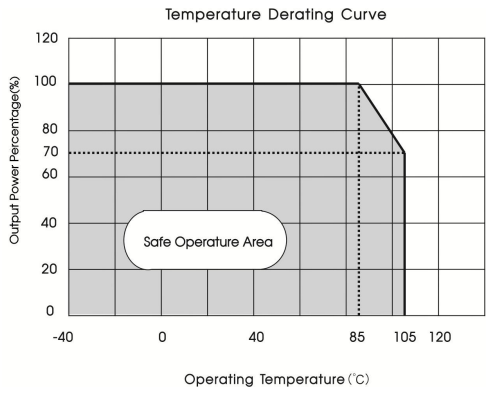
Electromagnetic Compatibility (EMC)

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

3.3V/5V/6.5V output



9/12/15V output

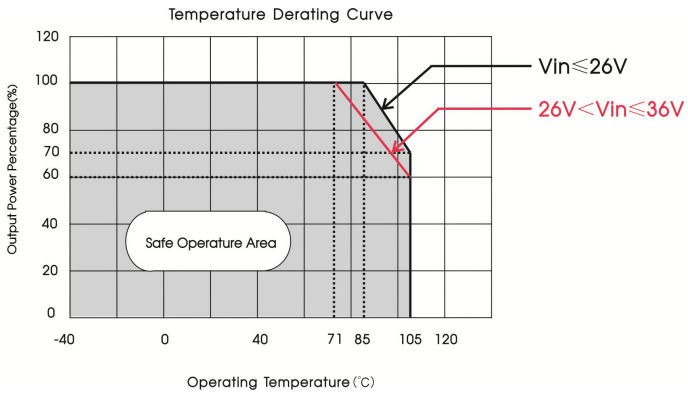
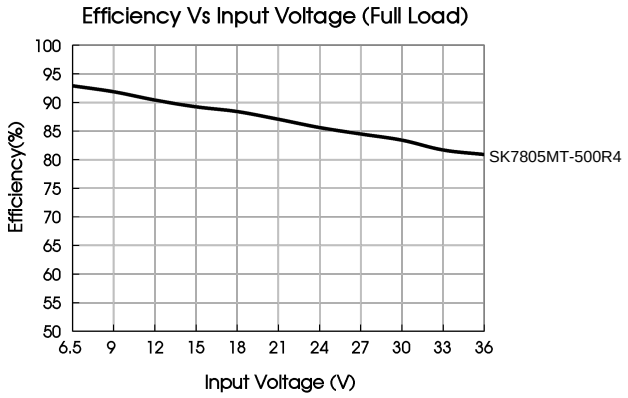
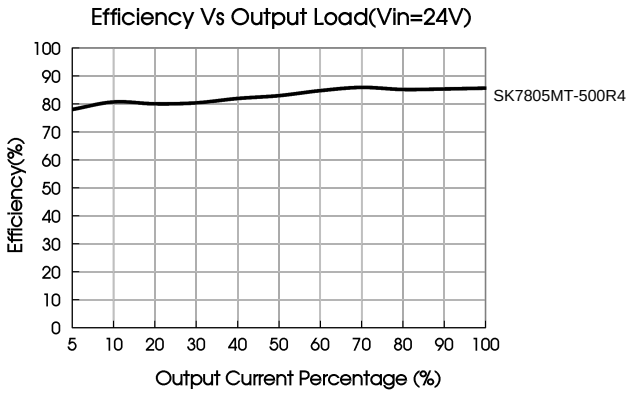


Fig. 1





Design Reference

1. Typical application

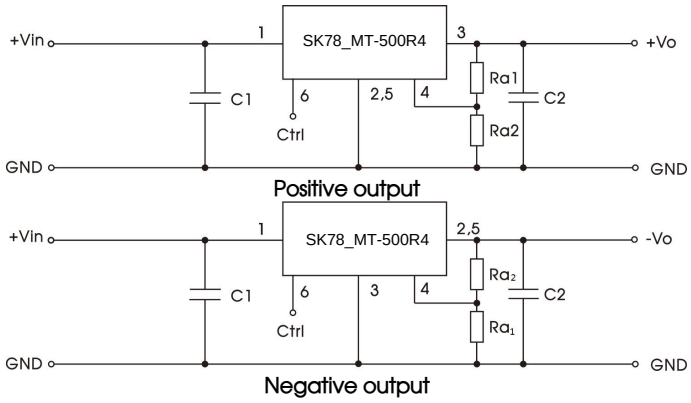


Fig. 2 Typical application circuit

Part No.	C1 (ceramic capacitor)	C2 (ceramic capacitor)	Ra1/Ra2 (Vadj resistance)
SK7803MT-500R4	10μF/50V	22μF/10V	Refer to Vadj resistance calculation
SK7805MT-500R4		22μF/10V	
SK78X6MT-500R4		22μF/16V	
SK7809MT-500R4		22μF/16V	
SK7812MT-500R4		22μF/25V	
SK7815MT-500R4		22μF/25V	

Table 1

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.

2. EMC compliance circuit

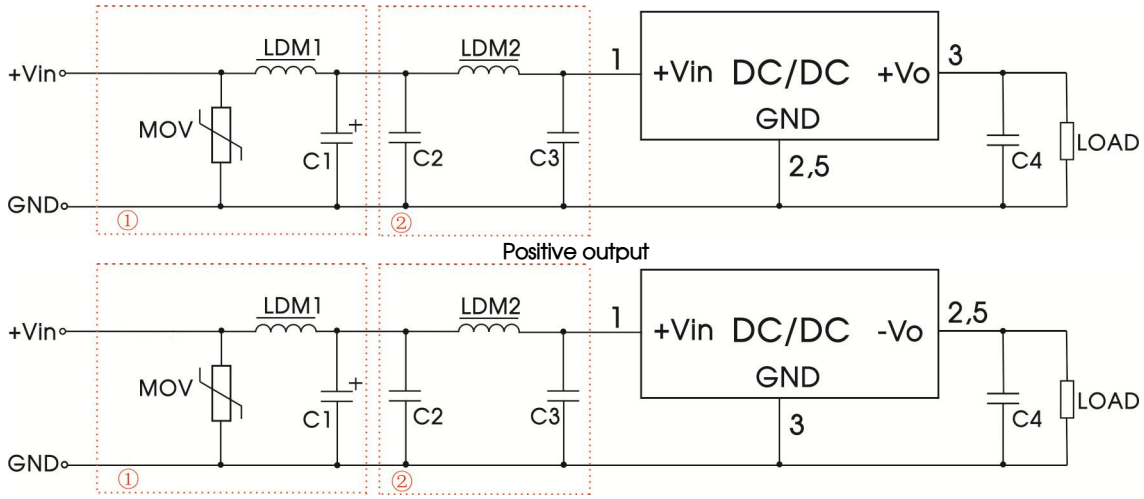
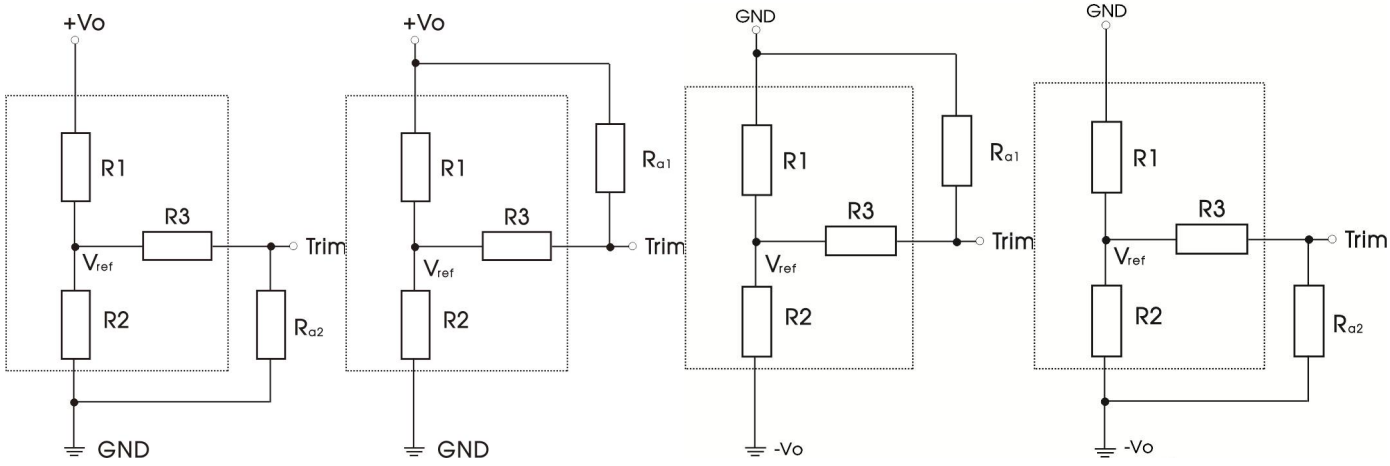


Fig.3 Recommended compliance circuit

Part No.	MOV	LDM1	C1	C2	LDM2	C3	C4
SK7803MT-500R4 (Positive output)	S20K30	82μH (CODACA-SP53-820K)	680μF /50V	10μF/50V	10μH (CODACA-SP53-100K)	0.47μF/50V	22μF/10V
SK7803MT-500R4 (Negative output)					22μH (CODACA-SP53-220K)	/	
SK7805MT-500R4					10μH (CODACA-SP53-100K)	/	
SK78X6/09MT-500R4					10μH (CODACA-SP53-100K)	1μF/50V	22μF/16V
SK7812/15MT-500R4					22μH (CODACA-SP53-220K)	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)



Positive output trim up | Positive output trim down | Negative output trim up | Negative output trim down

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

Calculating Trim resistor values:

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

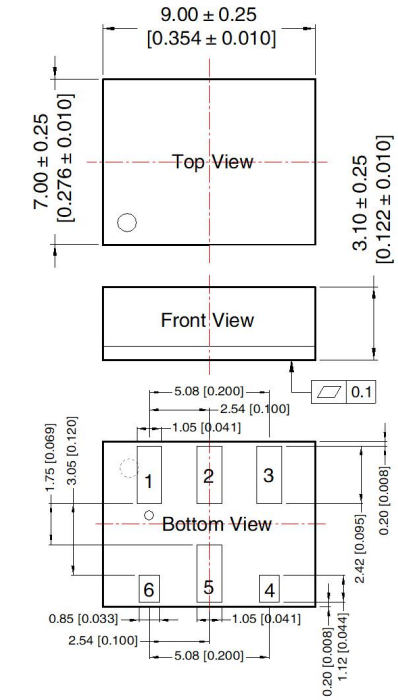
Trim down : $R_{a1}=\frac{aR_1}{R_1-a}-R_3,\quad a=R_1//(R_3+R_{a1})=\frac{V_o'-V_{ref}}{V_{ref}}R_2$

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

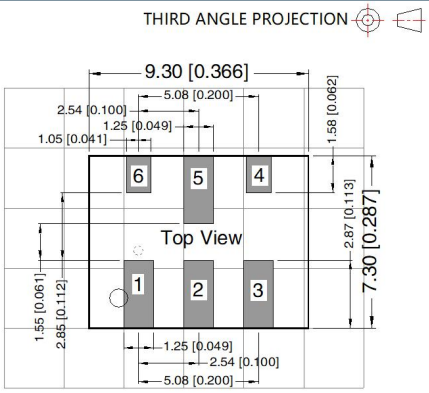
Table:

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											1048k	
16.5												17k

Dimensions and Recommended Layout



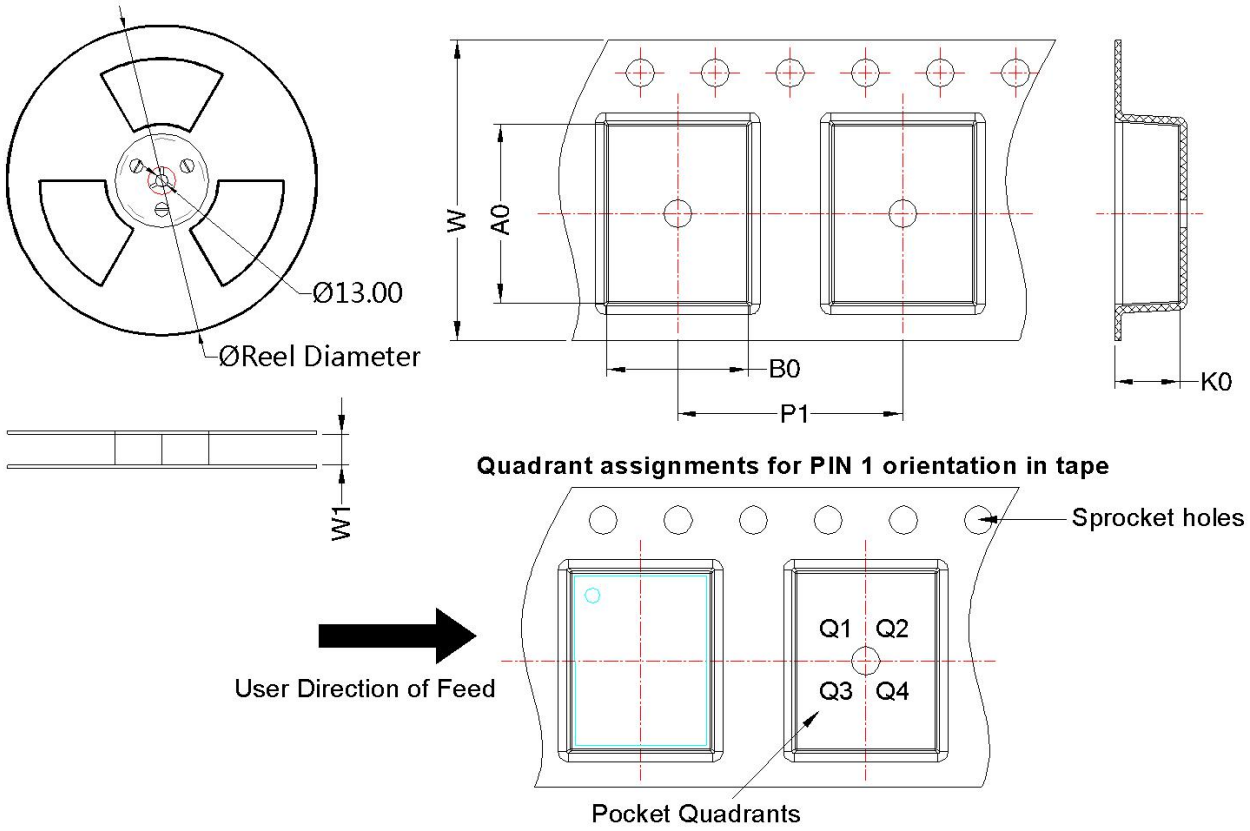
Note:
Unit :mm[inch]
Pin diameter tolerances : ± 0.10[± 0.004]



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

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
SK78xxMT-500R4	SMD	6	1200	330.0	12.4	9.56	7.56	3.5	12.0	16.0	Q1

Notes:

1. The maximum capacitive load offered were tested at nominal input voltage and full load;
2. 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;
3. All index testing methods in this datasheet are based on our company corporate standards;
4. We can provide product customization service, please contact our technicians directly for specific information;
5. Products are related to laws and regulations: see "Features" and "EMC";
6. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.