DC/DC Converter
SK78 _T-1000R3 Series

SCHMID-M

Wide input voltage, non-isolated & regulated single output

FEATURES

- High efficiency up to 95%
- No-load input current as low as 0.2mA
- Operating temperature range: -40℃ to +85℃
- Output short circuit protection
- SMD package
- Meets EN62368 standards
  （Pending）

sk78_T-1000R3 series are high efficiency switching regulators. The product is featured with high efficiency, low loss, short circuit protection and no heat sink requirement. They are widely used in industrial control, instrumentation, and electric power applications.

Selection Guide

Certification	Part Number	Input Voltage (VDC) Nominal (Range)	Output Voltage (VDC)	Max. Output Current (mA)	Efficiency (%/Typ.) (Min. Vin)/ (Max. Vin) @Full Load	Max. Capacitive Load(μF)
CE (Pending)	SK7801T-1000R3	12 (4.75-32)	1.5	1000	76/66	680
	SK78X2T-1000R3	12 (4.75-32)	1.8	1000	79/69	680
	SK7802T-1000R3	12 (4.75-32)	2.5	1000	86/74	680
	SK7803T-1000R3	24 (6.5-36)	3.3	1000	90/80	680
	SK7805T-1000R3	24 (8-36)	5	1000	93/85	680
	SK78X6T-1000R3	24 (10-36)	6.5	1000	93/86	680
	SK7809T-1000R3	24 (13-36)	9	1000	94/89	680
	SK7812T-1000R3	24 (16-36)	12	800	95/92	680

Note:For input voltage higher than 30 VDC, a 22uF/50V input capacitor is required.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
No-load Input Current		--	0.2	1	mA
Reverse Polarity Input		Forbidden			
Input Filter		Capacitor filter			
Remote ON/OFF	Module switch on	suspended or connected to TTL high level (3.2-5.5VDC)			
	Module switch off	pin connected to GND or low level (0-0.8VDC)			
	Input current when switched off	--	0.2	1	mA

Output Specifications

Item	Operating Conditions		Min.	Typ.	Max.	Unit
Output Voltage Accuracy	Full load, input voltage range	1.5/1.8/2.5/3.3VDC output	--	±2	±4	%
		Others	--	±2	±3	
Line Regulation	Full load, input voltage range	1.5/1.8/2.5VDC output	--	±0.3	±0.6	
		Others	--	±0.2	±0.4	
Load Regulation	Nominal input voltage,10% -100% load	1.5/1.8/2.5VDC output	--	0.8	±1.5	
		Others	--	0.3	±0.6	

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Ripple & Noise*	20MHz bandwidth	--	30	75	mVp-p
Temperature Coefficient	Operating temperature -40℃ to +85℃	--	--	±0.03	%/℃
Transient response deviation	Nominal input voltage, 25% load step change	--	50	150	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 will be 150mVp-p.

General Specifications

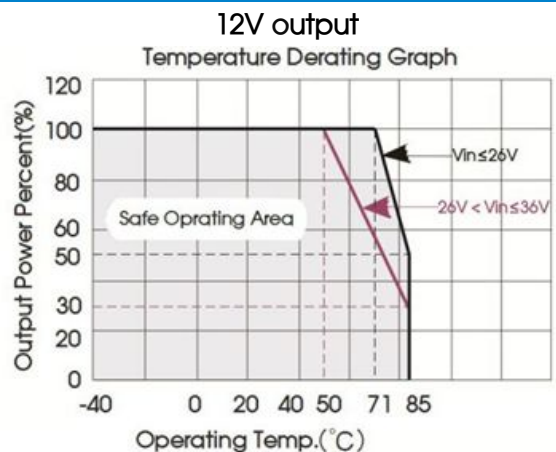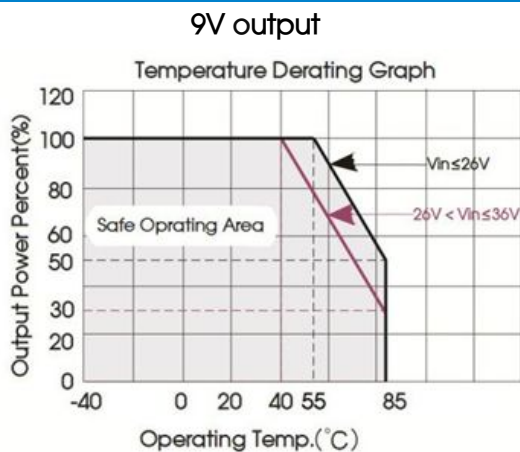| Item	Operating Conditions		Min.	Typ.	Max.	单位
Operating Temperature	see Fig. 1		-40	--	+85	℃
Storage Temperature			-55	--	+125	
Storage Humidity	Non-condensing		5	--	95	%RH
Reflow Soldering Temperature			Peak temp.≤245℃, maximum duration time≤60s at 217℃. For actual application, please refer to IPC/JEDEC J-STD-020D.1.			
Switching Frequency	Full load, nominal input voltage	1.5/1.8/2.5VDC output	--	370	--	KHz
		3.3/5/6.5VDC output	--	520	--	
		09/12VDC output	--	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	1.7g (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

9V output

12V output

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Other output

Temperature Derating Graph

Fig. 1

Efficiency Vs input Voltage (Full Load)

Efficiency Vs Output Load(Vin=24V)
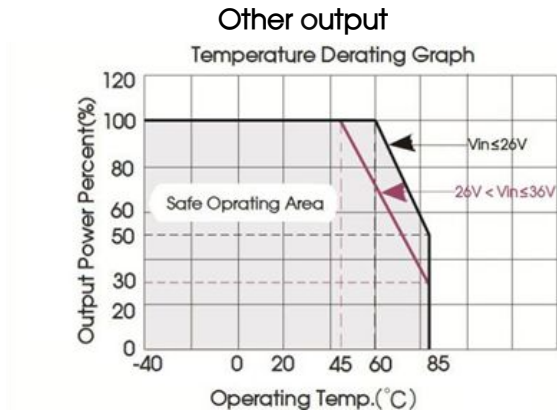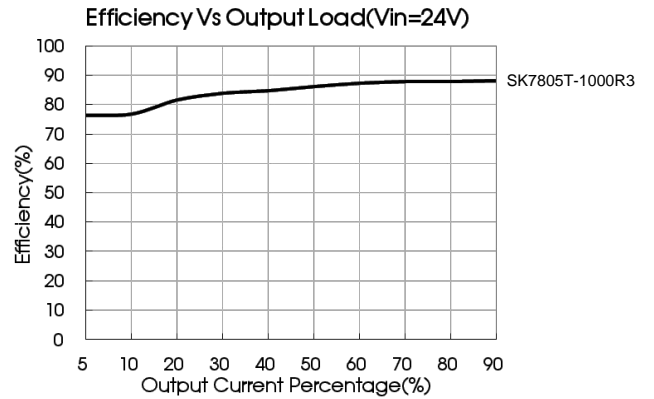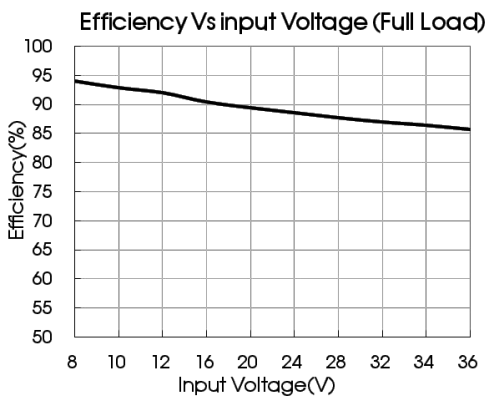
Design Reference

1. Typical application circuit

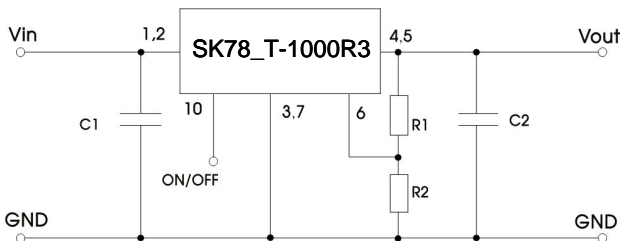Fig. 2 Typical application circuit

Part Number	C1 (ceramic capacitor)	C2 (ceramic capacitor)	Ra1/Ra2 (Vadj resistance)
SK7801T-1000R3		22µF/10V	
SK78X2T-1000R3		22µF/10V	
SK7802T-1000R3		22µF/10V	
SK7803T-1000R3	10µF/50V	22µF/10V	Refer to Vadj resistance calculation
SK7805T-1000R3		22µF/16V	
SK78X6T-1000R3		22µF/16V	
SK7809T-1000R3		22µF/16V	
SK7812T-1000R3		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.
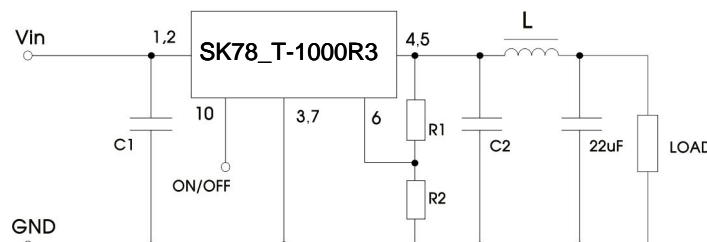

Fig. 3 "LC" filter application circuit

2. EMC solution-recommended circuit
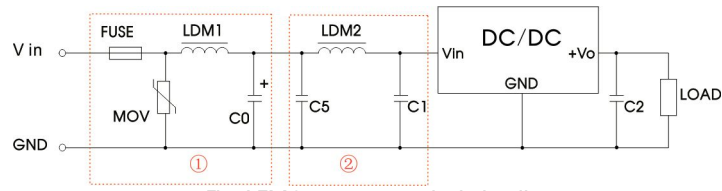
Fig.4 EMC recommended circuit

FUSE	MOV	LDM1	C0	C2	C1/C5	LDM2
Selected based on the actual input current from the customer	S20K30	82µH	680µF /50V	Refer to Sheet 1	4.7µF /50V	68µH

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)
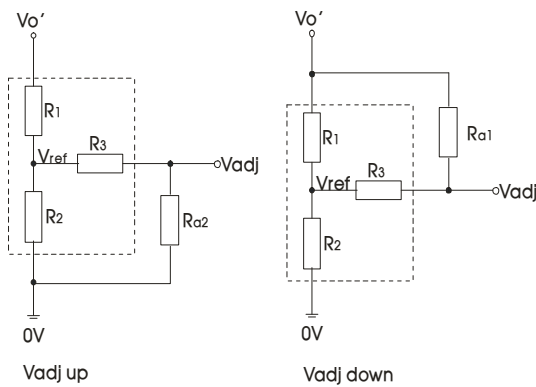
Calculation formula of Vadj resistance:

$$up: \ R_{a2} = \frac{aR_2}{R_2 - a} - R_3 \qquad a = \frac{Vref}{Vo' - Vref} \cdot R_1$$

$$down: \ R_{a1} = \frac{aR_1}{R_1 - a} - R_3 \qquad a = \frac{Vo' - Vref}{Vref} \cdot R_2$$

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

Vout(V)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
1.5	7.5	7.5	15	0.75
1.8	4.7	3.3	6.8	0.75
2.5	9.1	3.9	8.2	0.75
3.3	75	22	75	0.75
5	43	7.5	33	0.75
6.5	43	5.6	22	0.75
9	43	3.9	22	0.75
12	36	2.4	10	0.75

Note: The 1.5VDC output model only support Vadj up,do not support Vadj down.

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Dimensions and Recommended Layout

THIRD ANGLE PROJECTION

Note: Grid 2.54*2.54mm
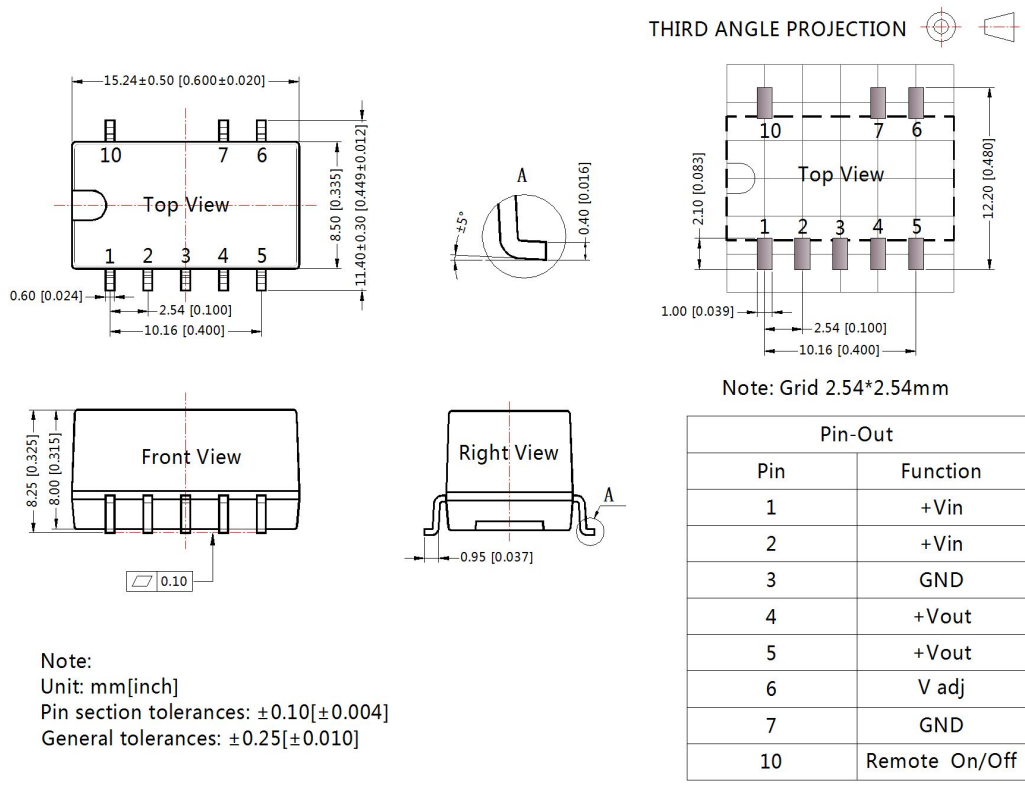
Note:
Unit: mm[inch]
Pin section tolerances: ±0.10[±0.004]
General tolerances: ±0.25[±0.010]

Pin-Out	
Pin	Function
1	+Vin
2	+Vin
3	GND
4	+Vout
5	+Vout
6	V adj
7	GND
10	Remote On/Off

NC: Pin to be isolated from circuitry

Notes:
1. The max. capacitive load should be tested within the input voltage range and under full load conditions;
2. Unless otherwise specified, data in this datasheet should be tested under the conditions of Ta=25℃, humidity<75%RH when inputting nominal voltage and outputting rated load;
3. All index testing methods in this datasheet are based on our Company's corporate standards;
4. 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;
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.