TSR 1 datasheet

Wide voltage input non-isolated regulator Output module power supply (three-terminal switching regulator)

- Wide input voltage range：5.0-36VDC
- High conversion efficiency (up to 96%), low no-load current: 0.5mA(typ)
- Pin-compatible with LM78xx series three-terminal linear regulators
- Output short-circuit protection (self-recovery)
- Operating temperature：-40℃～+85℃

This series module power supply is a three-end switching regulator, which has high efficiency, low loss, low heat output, no need to add heat sink, and can work stably and reliably. It makes up for the defects of low efficiency and large heat output of the previous three-terminal linear voltage regulator, and is the perfect substitute for the current three-terminal linear voltage regulator, which is widely used in industrial control system power supply, power monitoring system power supply, instrument power supply and other power systems.

Selection list

Model number	Input voltage range (nominal value)	Output rated voltage	Output rated current	Efficiency (%_typ) Vin_min/Vin_max @ Full load	Maximum capacitive load (μF)
TSR 1-2433	5.0-36V (24)	3.3V	1000mA	91/80	3000
TSR 1-2450	8.0-36V (24)	5.0V	1000mA	94/85	2000
TSR 1-24120	16-36V (24)	12V	1000mA	96/92	820
TSR 1-24150	20-36V (24)	15V	1000mA	96/93	680

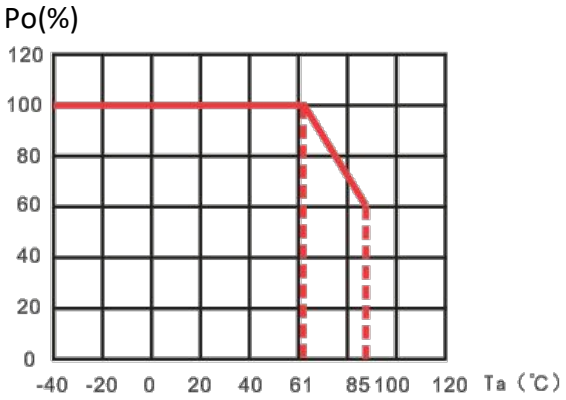
Product characteristics

item	Working condition	Min	Typ	Max	unit
No load input current	24V nominal input	--	0.5	1.5	mA

Output voltage accuracy	@100% load	-3	±1	+3	%
Linear adjustment rate	@Full load, Vin_min to Vin_max	-0.5	±0.3	+0.5	
Load adjustment rate	@ Nominal input, 10%-100% load	-0.75	±0.5	+0.75	
Dynamic response deviation	Nominal input @ load 50%-75%-50% variation	--	80	230	mV
Dynamic recovery time	Nominal input @ load 50%-75%-50% variation	--	200	500	μs

Product characteristics					
item	Working condition	Min	Typ	Max	unit
Ripple & Noise	20MHz bandwidth @Vin_nom,100% load	--	50	100	mVp-p
Short circuit protection		Sustainable, self-healing			
Coefficient of temperature drift	Nominal input @100% load	--	±0.03	--	%/℃
Operating ambient temperature	The temperature derating requirement is met	-40	--	+85	℃
Product working temperature rise	100% load @Vin_nom,Ta=25℃	--	45	--	
Storage temperature		-55	--	+125	
Storage humidity	non-condensing	--	--	95	%RH
MTBF	MIL-HDBK-217F@25℃	1000	--	--	KHours
Welding temperature	Hand welding	370±10℃@3～5Sec			
	Wave soldering welding	260±10℃@5～10Sec			
Hot swap		nonsupport			
Cooling mode		Natural air cooling			
Housing material		Black flame-retardant plastic housing			
weight		--	2	--	G
Apparent dimension	Length * width * height	11.6*7.5*10.2mm			

Temperature characteristic curve



Temperature drop curve

Precautions for use

1. Consideration of additional input capacitance:

Because there are all kinds of interference noises in the power supply side, the frequency is high, the duration is short, but the peak value is very high, in order to make the module power supply work stably and reliably, it is usually necessary to add a suitable absorption capacitance in its input side; In some cases, the lead between the power supply and the module power supply on the control board is very long, then it is necessary to connect an external filter capacitor near the input pin of the module power supply to achieve the effect of impedance matching. The greater the interference noise, the longer the line, the greater the required external capacitance value. Our company recommends the use of high frequency and low resistance electrolytic capacitors to meet the requirements, general application, can be selected according to the recommended values in the "Design reference" chapter. Please note: During testing or use, if the input voltage will be higher than 28V, it is necessary to connect 33uF high frequency low resistance electrolytic capacitor to the input terminal.

2, the consideration of the output filter capacitance:

In the actual application circuit, the load size of the module power supply varies, usually accompanied by large or small changes. In order to adapt to different use occasions and load requirements, and work more stably and reliably, it is necessary to add a suitable capacitor to the output end of the module power supply. This is mainly due to two considerations: one is to further reduce the output ripple and noise; On the other hand, the output capacitance is applied to further improve the response deviation caused by the load jump, so that the output voltage is more stable. However, the output end can not add too large capacity capacitance, the larger the output capacitance, the power supply needs to start the instantaneous current

provided by the power supply end will increase, too large capacitance may even cause the output voltage of the module can not be established; In addition, the output capacitor value is too large, the power supply is prone to output overrush when starting, in order to ensure that it works more safely and reliably, under the premise of output ripple and noise to meet the requirements, reduce the capacity of the output capacitor as much as possible, or use LC filter to replace the capacitor with a large capacity value. The maximum capacitive load in the selection list only means that the power supply can start normally when the total capacitance of its output is within this value, which is not recommended. Please see the "Design Reference" section for the recommended value.

3. Prevent hot swap test or use of the power module:

The so-called hot swap usually refers to inserting the power supply of a module into the circuit or removing it from the circuit when the power supply is not disconnected. The power supply does not support hot swap during use or testing. Because in the hot swap process, due to the current mutation will produce high voltage spike, it may cause damage; In another case, a mechanical switch is connected in series between the power supply and the input end of the module power supply, and the power supply is controlled through the mechanical switch. The mechanical switch will also produce high voltage spikes during on-off operation, which may also cause damage to the power supply. During the test or use of the module power supply, any operation that will produce high voltage spikes should not be ignored. Measures should be taken to prevent high voltage spikes from being directly added to the input end. For details, see the "Design Reference" section. Please note: During testing or use, it is necessary to ensure that the "GND" pin of the product is well connected to the GND of the power supply, otherwise the product will be damaged.

4, input high transient voltage peak protection:

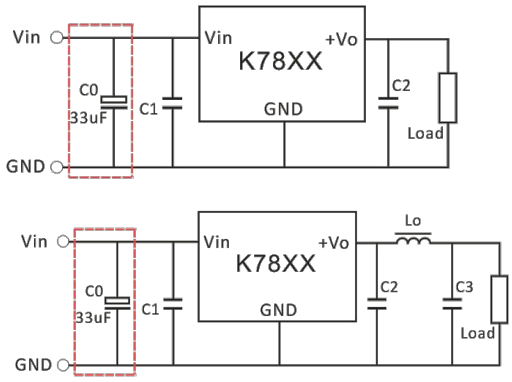
If the product is used in an environment with harsh electromagnetic interference, for example, the input end of the product shares the power supply with the inductive load, or the current loop at the power supply end is on/off, if not handled properly, there will be a high transient voltage spike in the power supply circuit, and this interference will not be dealt with, and too high peak voltage will enter the product input end. It is very likely to cause product damage. The suppression of high voltage spikes is very important to ensure the stable and reliable use of the product. Commonly used transient voltage suppression devices are varistor (MOV), transient voltage suppression diode (TVS) and so on. Different devices have advantages and disadvantages, please choose according to the use of the occasion and requirements, refer to the "Design Reference" section.

5, input polarity:

The input end of the product has no anti-reverse protection, please note: the input polarity will cause damage to the product when in use.

Design reference

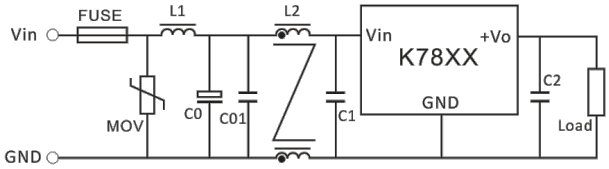
1、Application circuit:



C0	C1	Vo	C2/C3(MLCC)	Lo
Vin≧28VDC Time required addition	10uF/50V MLCC	3.3V	22uF/10V	2.2uH
		5.0V	22uF/10V	
		12V	22uF/25V	
		15V	22uF/25V	

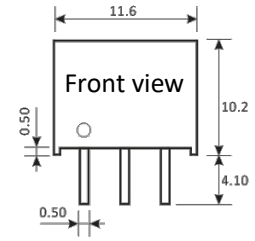
Table (1)

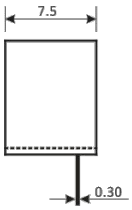
2、EMC Recommended circuit:

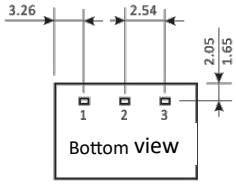


FUSE	Select according to the actual current	C01	10uF/50V(MLCC)
MOV	20D470K	L2	10mH
L1	300uH	C1	10uF/50V(MLCC)
C0	470uF/50V	C2	Refer to Table (1)

Appearance size and pin function







PIN Function

PIN	Function
1	VIN
2	GND
3	Vo

Dimension Unit： mm

Dimension Error： XX.X=±0.5mm,XX.XX=0.25mm

Note:

1. For our specific packaging information, please refer to "Product Shipping Packaging Instructions";
2. If the working load of the product is lower than the minimum load requirements, we cannot guarantee that the product performance can meet all performance indicators;
3. The maximum capacitive load is tested in the input voltage range and under full load conditions;
4. Unless otherwise specified, all indicators in this manual are measured at Ta=25℃, humidity <75%RH, nominal input voltage and rated output load;
5. All index test methods in this manual are based on the company's enterprise standards;
6. Our company can provide product customization, specific circumstances can directly contact our technical personnel;
7. Products related to laws and regulations: see "Product Characteristics", "EMC characteristics";
8. Our products shall be classified and stored in accordance with ISO14001 and relevant environmental laws and regulations after scrapping, and handed over to qualified units.