

SR037DB2 Inductorless Switching Power Supply

Introduction

The Supertex SR037 is an inductorless switching power supply controller intended for operation directly from a rectified 120/230VAC line. The operating principle is to activate a pass transistor (operating as a voltage follower) only when the input voltage is lower than 45V. Thus conduction only occurs with a low voltage drop across the pass transistor, resulting in more efficient operation compared to a standard linear regulator.

The SR037DB2 demo board contains all the circuitry needed to supply a low-current load. Included is input protection circuitry, a full wave bridge rectifier, an IGBT pass transistor, and output capacitors. Simply connect the demo board to an AC line. Provisions are made for modifying the demo board for various applications.

Specifications

AC Input	24VAC to 270VAC
	40Hz to 70Hz

Output Voltages

 $\begin{array}{c} V_{\text{UNREG}} & \text{11V to 19V} \\ V_{\text{REG}} & \text{5.0V \pm} 10\% \end{array}$

Output Current

 $\begin{array}{c} {\rm I}_{\rm REG} \\ \\ {\rm I}_{\rm REG} + {\rm I}_{\rm UNREG} \end{array} \hspace{0.5cm} \begin{array}{c} {\rm 50mA @ 120VAC} \\ \\ {\rm 20mA @ 230VAC} \end{array}$

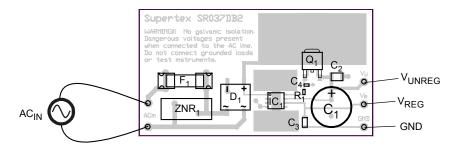
No-load Input Power 125mW typ @ 120VAC

580mW typ @ 230VAC

40mA @ 230VAC

Efficiency 38% typ @ 120V/90mA referenced to V_{UNREG} 31% typ @ 230V/40mA

Board Layout and Connections



WARNINGIII

Do not connect earth-grounded test instruments or loads. Doing so will short the AC line, resulting in damage to the instrument, load, or the SR03 circuit. Use floating instruments or differential probes. Do not use a transformer on the AC line.

WARNING!!!
No galvanic isolation. Dangerous voltages are present when connected to the AC line.

ACIN

Connect to the AC line. The AC input is protected by a 275V transient voltage suppressor and a 500mA fuse.

Do not use a transformer, either variable of fixed, on the AC line. The high inductance of a transformer interferes with the normal operation of the SR037.

GND

Circuit common.

Note that since galvanic isolation is not provided, connecting this point to an earth-grounded instrument (such as an oscilloscope) will short the AC line, resulting in circuit and/or instrument damage.

Also note that GND may be at a higher potential with respect to earth ground even if the AC is switched off. Use caution!

VUNREG

Unregulated output. Nominal output voltage is 17V unloaded. At full load, output voltage drops to 14V typ at 120VAC and 12V typ at 230VAC. This output will have about $1.3V_{P-P}$ of 100/120Hz ripple at full load.

Do not connect earth-grounded loads.

V_{REG}

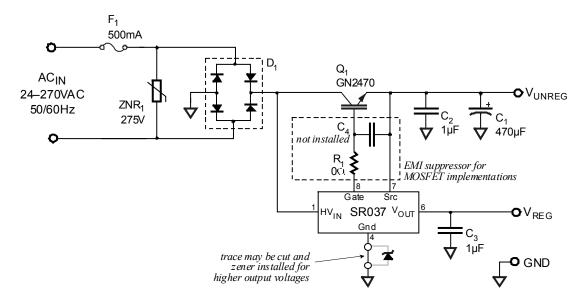
The regulated output, nominally 5 volts. Output current capability is 50mA at 120VAC and 20mA at 230VAC. This output is supplied by a linear regulator internal to the SR03, which in turn is supplied by the unregulated output.

Do not connect earth-grounded loads.

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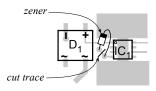
SR037DB2 Schematic



Desig	Desc	Value	Rating	Mfg	PN
F ₁	Fuse, 2AG slo-blo	500mA	250V	any	
ZNR ₁	Metal oxide varistor	275V	50A	any	
D ₁	Full wave bridge rectifier		1A, 800V	any	
Q_1	IGBT		700V	Supertex	GN2470K4
R ₁	Zero ohm jumper	Ω 0		any	
C ₁	Capacitor, X7R	1μF	50V	any	
C ₂	Capacitor, alum	470µF	35V	any	
C ₃	Capacitor, X7R	1µF	15V	any	
C ₄	Not installed				
IC ₁	Inductorless power supply controller			Supertex	SR037SG

Higher Output Voltage

The SR037DB2 demo board may be modified to provide higher output voltages. Cut the ground connection to the SR037 and install a zener in the 2 holes provided, with the polarity shown. The zener may be low power (100mW).



Both V_{UNREG} and V_{REG} will increase by the zener voltage. Note that it may be necessary to replace the output capacitors ($C_1 - C_3$) with ones having higher voltage ratings.

Constant Current Output

If a constant-current output is desired, such as for driving LEDs, the circuit of Figure 9 on the SR03x data sheet may be implemented by cutting the ground trace to the SR037 and connecting the current regulator circuit shown in the data sheet .

Lower Output Current

If combined output current requirements ($I_{UNREG} + I_{REG}$) are less than 50mA at 120VAC or less than 20mA at 230VAC, the D-Pak GN2470 IGBT may be replaced with a SOT-89 VN2460 MOSFET (pads provided). Since the VN2460 has a lower voltage rating (600V vs. 700V), it will be necessary to replace the transient voltage suppressor (ZNR₁) with one having a lower clamping voltage, such as a P6KE400CA.

Since MOSFETs have faster switching speeds than IGBTs, conducted EMI will be greater. To slow the MOSFET switching time, thus reducing EMI, replace R_1 with a $180 \text{k}\Omega$ resistor and install a 220 pF, 25 V capacitor at C_4 .

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