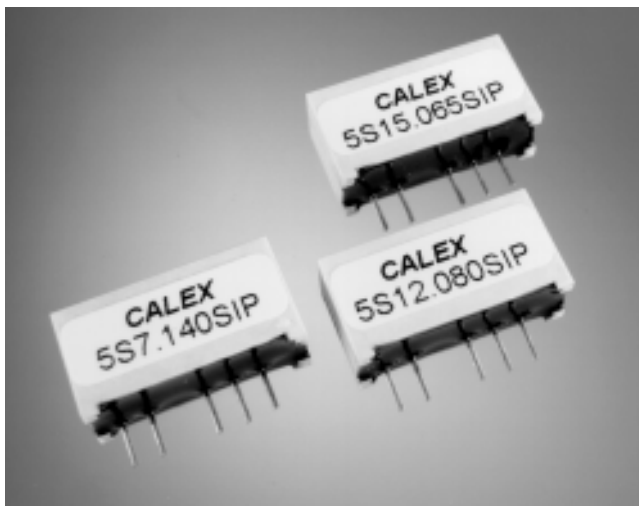


1 Watt SIP Single Series DC/DC Converters



Features

- High Isolation, 3000 VDC
- Operating Range of 4.5 to 5.5 Volts
- Semi-Regulated 1 Watt Outputs
 - 5, 12, 15 and 6.5, 7, 14, 17, 24 Volt Outputs
- Simple Four Terminal Operation
- Small SIP package, Fits in 0.19 sq.in. of PCB Area
- Low Noise Operation
- 5 Year Warranty

Description

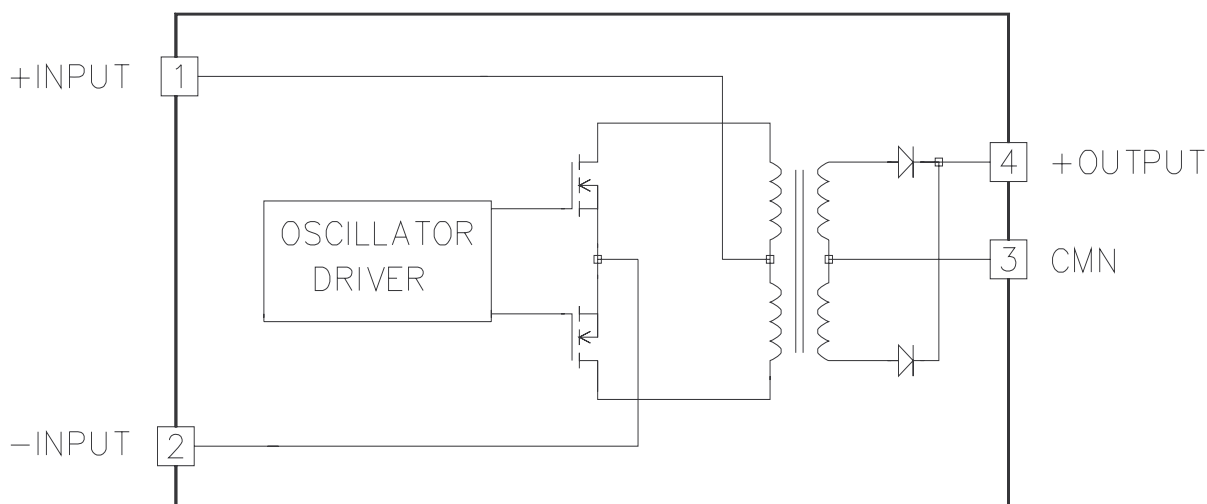
The CALEX SIP is specifically designed to provide nonstandard output voltages and isolation for 5 volt digital systems. The series provides semi-regulated outputs of 5, 6.5, 12, 15, and 24 volts for directly driving your circuits or 7, 14 and 17 volt outputs for driving three terminal regulators.

The high efficiency operation of typically 74% for a 12 volt output means efficient use of your system power.

Easy four terminal operation makes using the converter a snap. Just plug it in and you are ready to solve those nasty analog problems that arise when only 5 volt digital power is available in your system.

| Selection Chart | | | | | |
|-----------------|-----------------|-----|--------|-----|---------|
| Model | Input Range VDC | | Output | | |
| | Min | Max | VDC | mA | Power W |
| 5S5.150SIP | 4.5 | 5.5 | 5.0 | 150 | ¾ |
| 5S6.145SIP | 4.5 | 5.5 | 6.5 | 145 | 1 |
| 5S7.140SIP | 4.5 | 5.5 | 7.0 | 140 | 1 |
| 5S12.080SIP | 4.5 | 5.5 | 12.0 | 80 | 1 |
| 5S14.070SIP | 4.5 | 5.5 | 14.0 | 70 | 1 |
| 5S15.065SIP | 4.5 | 5.5 | 15.0 | 65 | 1 |
| 5S17.060SIP | 4.5 | 5.5 | 17.0 | 60 | 1 |
| 5S24.040SIP | 4.5 | 5.5 | 24.0 | 40 | 1 |

1 Watt Sip Series Block Diagram



1 Watt SIP Single Series DC/DC Converters

| Input Parameters* | | | | | | | | | | | |
|----------------------|-----------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|--------|----|
| Model | | 5S5.150SIP | 5S6.145SIP | 5S7.140SIP | 5S12.080SIP | 5S14.070SIP | 5S15.065SIP | 5S17.060SIP | 5S24.040SIP | Units | |
| Voltage Range | MIN | 4.5 | | | | | | | | VDC | |
| | MAX | 5.5 | | | | | | | | | |
| Reflected Ripple (1) | TYP | 50 | 65 | 65 | | | | | | mA P-P | |
| Input Current | Full Load | TYP | 207 | 255 | 261 | 243 | 248 | 250 | 257 | 253 | mA |
| | No Load | TYP | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 28 | |
| Efficiency | TYP | 69 | 69 | 70 | 74 | 74 | 75 | 75 | 75 | % | |
| Switching Frequency | TYP | 350 | | | | | | | | kHz | |

| Output Parameters* | | | | | | | | | | |
|--|-----------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|--------|
| Model | | 5S5.150SIP | 5S6.145SIP | 5S7.140SIP | 5S12.080SIP | 5S14.070SIP | 5S15.065SIP | 5S17.060SIP | 5S24.040SIP | Units |
| Output Voltage | | 5 | 6.5 | 7 | 12 | 14 | 15 | 17 | 24 | VDC |
| Output Voltage Accuracy (2) | MIN | 4.75 | 6.175 | 6.65 | 11.40 | 13.30 | 14.25 | 16.15 | 22.8 | VDC |
| | TYP | 5.00 | 6.500 | 7.00 | 12.00 | 14.00 | 15.00 | 17.00 | 24.0 | |
| | MAX | 5.25 | 6.825 | 7.35 | 12.60 | 14.70 | 15.75 | 17.85 | 25.2 | |
| Output Voltage, No Load | TYP | 7 | 9 | 10 | 16 | 19 | 21 | 24 | 31 | VDC |
| Rated Load Range | MIN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | mA |
| | MAX | 150 | 145 | 140 | 80 | 70 | 65 | 60 | 40 | |
| Load Regulation (3) | 75% - 20% Load | +8 | | | | | | | | % |
| | 75% - 100% Load | -5 | | | | | | | | |
| Line Regulation (4) | TYP | 1.2 | | | | | | | | % / % |
| Noise, Peak - Peak (1) | TYP | 65 | | | | 40 | | | | mV P-P |
| Temperature Coefficient | TYP | 400 | | | | | | | | ppm/°C |
| Short Circuit Protection to Common (5) | | Momentary | | | | | | | | |

NOTES

* **All parameters measured at Tc = 25°C, 5.00V input voltage, full rated load and a 10µF solid tantalum capacitor connected across the input and output pins, unless otherwise noted. Refer to the CALEX Application Notes for the definition of terms, measurement and other information.**

(1) Noise is measured per CALEX Application Notes. Measurement bandwidth is 20 MHz. Input Reflected Ripple and output noise are measured with a 10µF tantalum capacitor connected across the input and output pins.

General Information

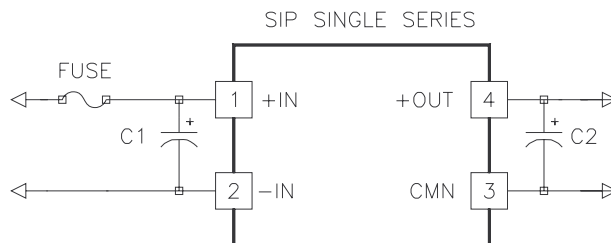
The 1 Watt SIP series provides isolated semi-regulated outputs of 5, 6.5, 7, 12, 14, 15, 17, and 24 VDC. The high efficiency low noise push-pull design operates at 350 kHz which reduces to a minimum your external filter requirements. The converter is packaged in a non-conductive plastic case and can be water washed after assembled to your main PC board.

Applying The Input

Figure 1 shows the recommended input connections for the 1 Watt Output SIP series. This series is only protected for momentary output short circuits to common so a fast acting fuse is recommended to protect the input circuit. It should not be omitted as it serves to prevent unlimited current from flowing in the case of an overcurrent at the load.

C1 may not be required when the power source is less than 2" from the unit. The source impedance should be less than

- (2) Output Voltage Accuracy measured at 75% of maximum Rated Load.
- (3) Load Regulations measured relative to 75% of maximum Rated Load Current. See Output Voltage vs. Output Load Curves.
- (4) Line Regulation is for a 1.0% change in Input Voltage.
- (5) Use input fuse for protection. See Applying the Input.
- (6) The case Thermal Impedance is specified as the case temperature rise over ambient per package watt dissipated.
- (7) Specifications subject to change without notice.
- (8) Water Washability - Calex DC/DC converters are designed to withstand most solder/wash processes. Careful attention should be used when assessing the applicability in your specific manufacturing process. Converters are not hermetically sealed.



C1 = 10µF. SEE APPLYING THE INPUT.
C2 = 10µF MINIMUM. SEE APPLYING THE OUTPUT.

Figure 1. 1 Watt SIP Series Typical Application

0.5 ohm over the frequency range of DC to 350 kHz. A 10µF solid tantalum capacitor will satisfy the requirements for C1, and should be within 2" of the converter.

1 Watt SIP Single Series DC/DC Converters

| General Specifications* | | | |
|---|------------------------|------------|-------------------|
| All Models | | | Units |
| Isolation | | | |
| Isolation Voltage Input to Output 10 μ A | MIN | 3000 | VDC |
| Input to Output Capacitance | TYP | 25 | pF |
| Environmental | | | |
| Case Operating Range | | | |
| No Derating | MIN MAX | -25 +85 | $^{\circ}$ C |
| Storage Range | MIN MAX | -40 100 | $^{\circ}$ C |
| Thermal Impedance (θ) | TYP | 58 | $^{\circ}$ C/Watt |
| Unit Weight | TYP | 0.1 | oz |
| Case Material | Non Conductive Plastic | | |

Very Low Noise Input Circuit

Figure 2 shows a very low noise input circuit that may be used with the converters. This circuit will reduce the input reflected ripple current to less than 5 mA peak to peak. L1 should be sized to handle the maximum DC current of your application. C1 must be used if L1 is required in the circuit.

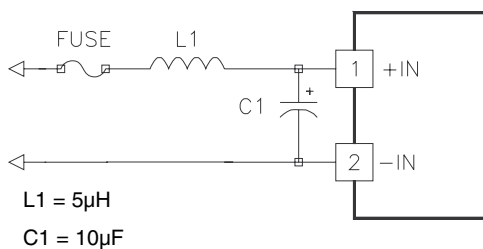


Figure 2.

This circuit will reduce the input reflected ripple current to less than 5 mA peak to peak. See the discussion in the text for selecting C1 and L1.

Applying The Output

Figure 1 shows the typical output connection for the converter. C2 is required to filter the output. It must be 10 μ F minimum and can be made up of from the bypass capacitors already used in your application. Increasing C2 will lower the output noise.

Operation With Light Loads

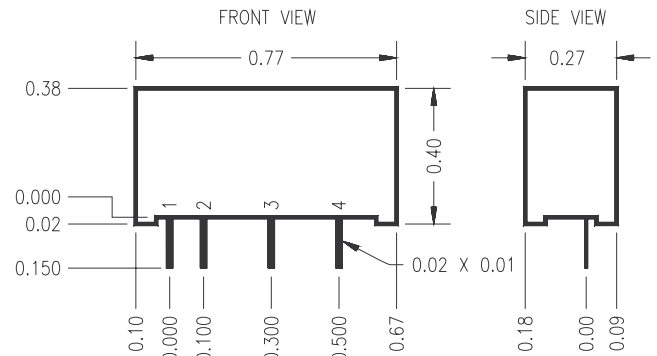
This converter uses a semi-regulated design. The output voltage will vary as the load is changed, increasing as the load is decreased. See the Output Voltage vs. Output Load curve.

Operation With Changing Input Voltage

The output will change proportionally to a change in the input voltage. The typical output voltage change is 1.2% per % change in input voltage.

Low Noise Output Circuit

The circuit shown in Figure 3 can be used to reduce the output noise to below 4 mV p-p over a 20 MHz bandwidth. Size



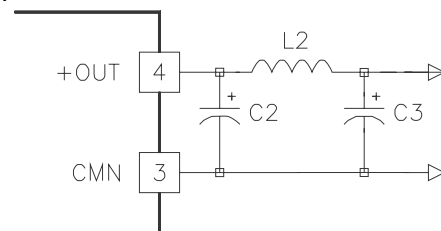
Mechanical tolerances unless otherwise noted:

X.XX dimensions: \pm 0.020 inches

X.XXX dimensions: \pm 0.010 inches

| Pin | Function |
|-----|----------|
| 1 | +INPUT |
| 2 | -INPUT |
| 3 | CMN |
| 4 | +OUTPUT |

inductor L2 appropriately for the maximum expected load current. All the ground connections must be as short as possible back to the CMN pin. The filter should be placed as close as possible to the converter, even if your load is at some distance.



C2,C3 = 10 μ F

L2 = 5 μ H

Figure 3.

This circuit can reduce the output noise to below 4mV P-P over a 20 MHz bw. Size L2 for the maximum expected load current. Place as close as possible to the converter.

Negative Outputs

A negative output voltage is obtained by connecting the +Output pin to the low side of the load, and taking the negative output from the CMN pin of the converter.

Grounding

The input and output sections are fully floating and isolated from each other. They may be operated fully floating or with a common connection between the input and output.

1 Watt SIP Single Series DC/DC Converters

Temperature Derating

The 1 Watt Output SIP series can be operated up to a +85°C case temperature. Case temperature can be roughly calculated from ambient by knowing that the case temperature rise is approximately 58°C per package watt dissipated.

For example: If a 5S12.080SIP is delivering 0.9 watts at 5V input, at what ambient could it expect to run with no additional cooling such as moving air?

Efficiency is approximately 74% which leads to an input power of 1.2 watts. The internal power loss is $1.2 - .9 = 0.30$ watts. The case temperature rise will be $0.30W \times 58^\circ C/W = 17^\circ C$. This number is subtracted from the maximum case

temperature rating of 85°C to get 68°C, which is the maximum ambient operating temperature.

This example calculation is for an application with no extra air flow for cooling. Extra cooling air will greatly effect the maximum ambient temperature. Exact internal power loss depends upon the efficiency, input voltage, and load in the application.

The above example is a rough approximation to the maximum ambient temperature. Because of the difficulty of defining ambient temperature, these calculations should be verified by actual measurement before committing to a production design.

Typical Performance: (Tc=25°C)

