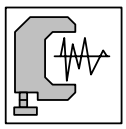
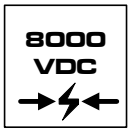
# S2E00 Series

*1.5W, Ultra-High Isolation DIP, Single & Dual Output DC/DC Converters*


### Key Features

- *Low Cost*
- *8000VDC Isolation*
- *MTBF > 2,000,000 Hours*
- *30mV P−P Ripple and Noise*
- *Input 5, 12 and 15VDC*
- *Output 5, 12, 15, ±5, ±12 and ±15VDC*
- *Temperature Performance −40℃ to +85℃*
- *Low Isolation Capacitance*
- *Low Leakage Current*


Low Noise



I/O Isolation

Low Cost

Minmax's S2E00 Model 1.5W DC/DC's are specially designed to provide 30mA output ripple, continuous short circuit in a low−profile 24−pin DIP package.

The series consists of 18 models with input voltages of 5V, 12V and 15VDC which offers regulated output voltages of 5V, 12V, 15V, ±5V, ±12V and ±15VDC.

The −40°C to +85°C operating temperature range makes it ideal for data communication equipments, mobile battery driven equipments,distributed power systems, telecommunication equipments, mixed analog/digital subsystems, automatic test instrumentation and industrial robot systems.

### Absolute Maximum Ratings

| Parameter | | Min. | Max. | Unit |
|---|---|---|---|---|
| Input Surge Voltage ( 1000 mS ) | 5VDC Input Models | −0.7 | 7 | VDC |
| | 12VDC Input Models | −0.7 | 17 | VDC |
| | 15VDC Input Models | −0.7 | 21 | VDC |
| Lead Temperature (1.5mm from case for 10 Sec.) | | −−− | 260 | ℃ |
| Internal Power Dissipation | | −−− | 1,000 | mW |

*Exceeding the absolute maximum ratings of the unit could cause damage. These are not continuous operating ratings.*

### Environmental Specifications

| Parameter | Conditions | Min. | Max. | Unit |
|---|---|---|---|---|
| Operating Temperature | Ambient | −40 | +85 | ℃ |
| Operating Temperature | Case | −40 | +95 | ℃ |
| Storage Temperature | | −55 | +125 | ℃ |
| Humidity | | −−− | 95 | % |
| Cooling | Free−Air Convection | | | |

## Model Selection Guide

| Model Number | Input Voltage | Output Voltage | Output Current | | Input Current | | Reflected Ripple Current | Efficiency |
|---|---|---|---|---|---|---|---|---|
| | | | Max. | Min. | @Max. Load | @No Load | | @Max. Load |
| | VDC | VDC | mA | mA | mA (Typ.) | mA (Typ.) | mA (Typ.) | % (Typ.) |
| S2E01 | 5 (4.5 ~ 5.5) | 5 | 300 | 0 | 400 | 50 | 30 | 75 |
| S2E02 | | 12 | 125 | | 400 | | | 75 |
| S2E03 | | 15 | 100 | | 400 | | | 75 |
| S2E04 | | ±5 | ±150 | | 400 | | | 75 |
| S2E05 | | ±12 | ±63 | | 400 | | | 75 |
| S2E06 | | ±15 | ±50 | | 400 | | | 75 |
| S2E07 | 12 (10.8 ~ 13.2) | 5 | 300 | 0 | 167 | 30 | 25 | 75 |
| S2E08 | | 12 | 125 | | 167 | | | 75 |
| S2E09 | | 15 | 100 | | 167 | | | 75 |
| S2E10 | | ±5 | ±150 | | 167 | | | 75 |
| S2E11 | | ±12 | ±63 | | 167 | | | 75 |
| S2E12 | | ±15 | ±50 | | 167 | | | 75 |
| S2E13 | 15 (13.5 ~ 16.5) | 5 | 300 | 0 | 133 | 30 | 20 | 75 |
| S2E14 | | 12 | 125 | | 133 | | | 75 |
| S2E15 | | 15 | 100 | | 133 | | | 75 |
| S2E16 | | ±5 | ±150 | | 133 | | | 75 |
| S2E17 | | ±12 | ±63 | | 133 | | | 75 |
| S2E18 | | ±15 | ±50 | | 133 | | | 75 |

## Capacitive Load

| Models by Vout | 5V | 12V | 15V | ±5V # | ±12V # | ±15V # | Unit |
|---|---|---|---|---|---|---|---|
| Maximum Capacitive Load | 470 | 470 | 470 | 220 | 220 | 220 | uF |

**# For each output**

## Input Fuse Selection Guide

| 5V Input Models | 12V Input Models | 15V Input Models |
|---|---|---|
| 1000mA Slow – Blow Type | 250mA Slow – Blow Type | 250mA Slow – Blow Type |

## Input Specifications

| Parameter | Model | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Start Voltage | 5V Input Models | 4.5 | 5 | 5.5 | VDC |
| | 12V Input Models | 10.8 | 12 | 13.2 | |
| | 15V Input Models | 13.5 | 15 | 16.5 | |
| Reverse Polarity Input Current | All Models | --- | --- | 0.5 | A |
| Short Circuit Input Power | | --- | --- | 1000 | mW |
| Input Filter | | Pi Filter | | | |

## Output Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Output Voltage Accuracy | | --- | ±2.0 | ±4.0 | % |
| Output Voltage Balance | Dual Output, Balanced Loads | --- | ±0.5 | ±2.0 | % |
| Line Regulation | For Vin Change of 1% | --- | ±1.2 | ±1.5 | % |
| Load Regulation(5V Output) | Io=20% to 100% | --- | ±7.0 | ±10 | % |
| Load Regulation(±5V Output) | | --- | ±8.0 | ±12 | % |
| Load Regulation(12,±12V Output) | | --- | ±6.0 | ±8.0 | % |
| Load Regulation(15,±15V Output) | | --- | ±4.0 | ±6.0 | % |
| Ripple & Noise (20MHz) | | --- | 30 | 40 | mV P-P |
| Ripple & Noise (20MHz) | Over Line, Load & Temp. | --- | --- | 50 | mV P-P |
| Ripple & Noise (20MHz) | | --- | --- | 15 | mV rms |
| Temperature Coefficient | | --- | ±0.01 | ±0.02 | %/°C |
| Output Short Circuit | Continuous | | | | |

## General Specifications

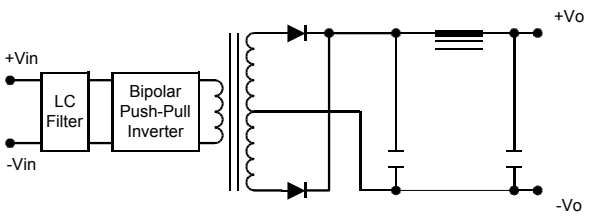
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Isolation Voltage Rated | 60 Seconds | 8000 | --- | --- | VDC |
| Isolation Voltage Test | Flash Tested for 1 Second | 8800 | --- | --- | VDC |
| Leakage Current | 240VAC, 60Hz | --- | --- | 2 | uA |
| Isolation Resistance | 500VDC | 10 | --- | --- | GΩ |
| Isolation Capacitance | 100KHz,1V | --- | 10 | 15 | pF |
| Switching Frequency | | 50 | --- | 100 | KHz |
| MTBF | MIL-HDBK-217F @ 25°C, Ground Benign | 2000 | --- | --- | K Hours |

### Notes :

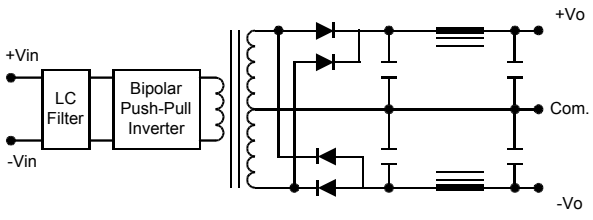
1. Specifications typical at Ta=+25°C, resistive load, nominal input voltage, rated output current unless otherwise noted.
2. Ripple & Noise measurement bandwidth is 0-20 MHz.
3. All DC/DC converters should be externally fused at the front end for protection.
4. Operation under no-load conditions will not damage these modules; however, they may not meet all specifications listed.
5. Other input and output voltage may be available, please contact factory.
6. Specifications subject to change without notice.

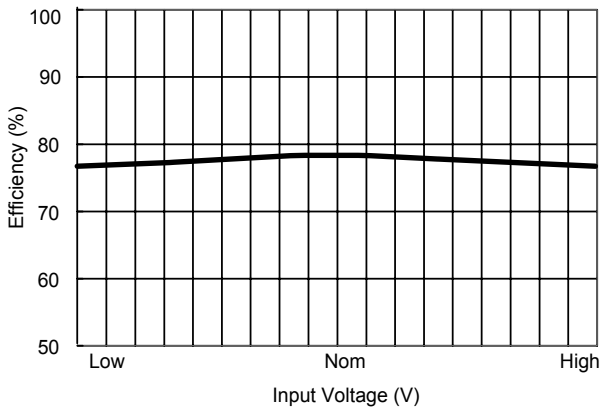
## Block Diagram

### Single Output

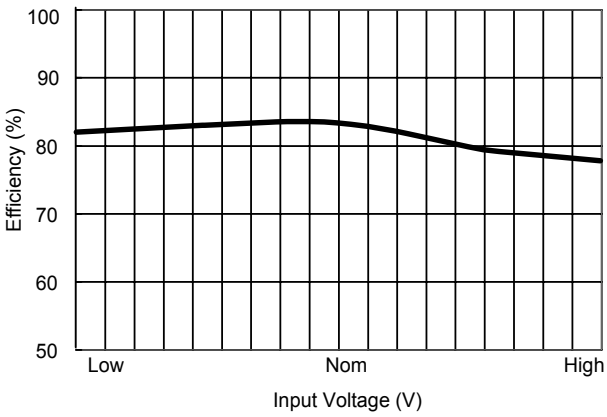



### Dual Output

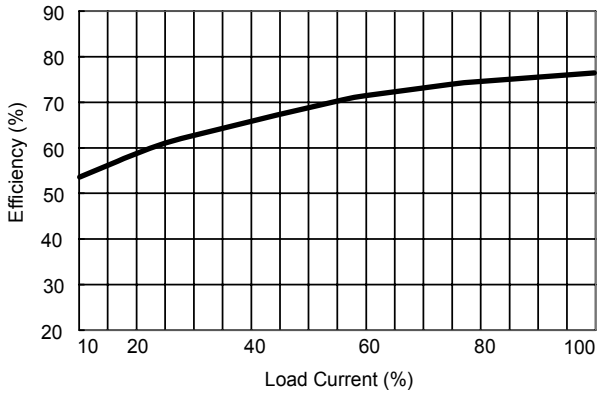




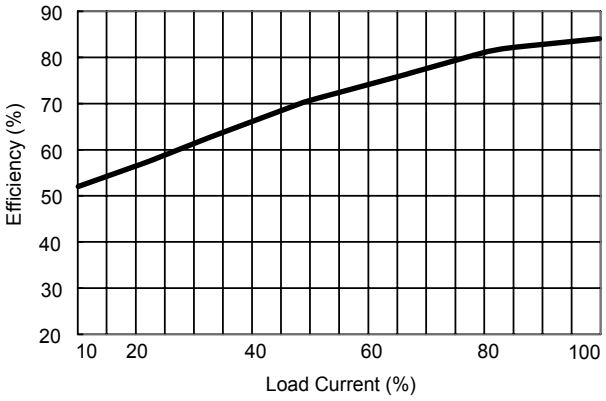

***Efficiency vs Input Voltage ( Single Output )***



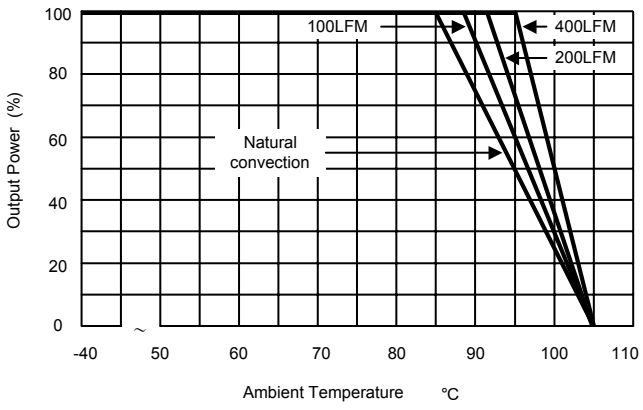

***Efficiency vs Input Voltage ( Dual Output )***




***Efficiency vs Output Load ( Single Output )***




***Efficiency vs Output Load ( Dual Output )***




***Derating Curve***

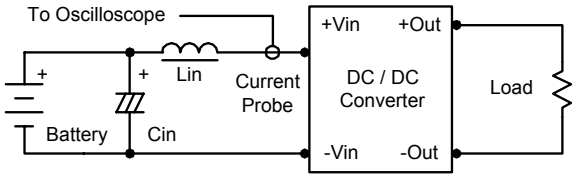
## Test Configurations

### Input Reflected-Ripple Current Test Setup

Input reflected−ripple current is measured with a inductor Lin (4.7uH) and Cin (220uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance.

Capacitor Cin, offsets possible battery impedance.

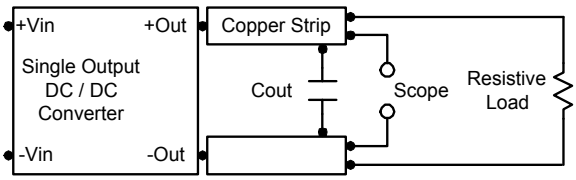
Current ripple is measured at the input terminals of the module, measurement bandwidth is 0−500 KHz.

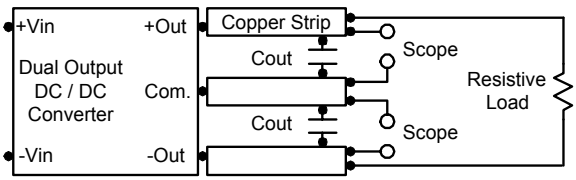



### Peak-to-Peak Output Noise Measurement Test

Use a Cout 0.33uF ceramic capacitor.

Scope measurement should be made by using a BNC socket, measurement bandwidth is 0−20 MHz. Position the load between 50 mm and 75 mm from the DC/DC Converter.




## Design & Feature Considerations

### Maximum Capacitive Load

The S2E00 series has limitation of maximum connected capacitance at the output.

The power module may be operated in current limiting mode during start−up, affecting the ramp−up and the startup time.

For optimum performance we recommend 220uF maximum capacitive load for each dual outputs and 470uF capacitive load for single outputs.

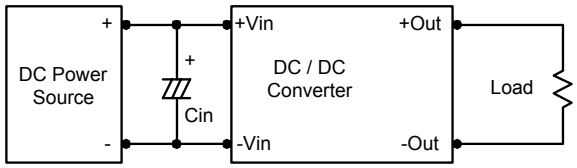
The maximum capacitance can be found in the data sheet.

### Input Source Impedance

The power module should be connected to a low ac−impedance input source. Highly inductive source impedances can affect the stability of the power module.

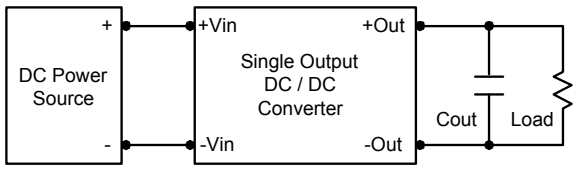
In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.

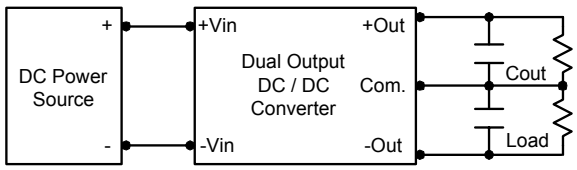
Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 2.2uF for the 5V input devices, a 1.0uF for the 12V input devices and a 0.47uF for the 15V devices.




### Output Ripple Reduction

A good quality low ESR 1.5uF capacitor connected as colse as possible to the load is recommended.

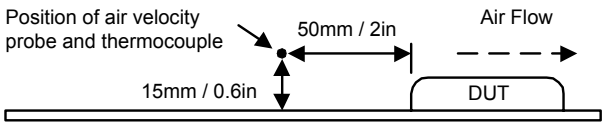


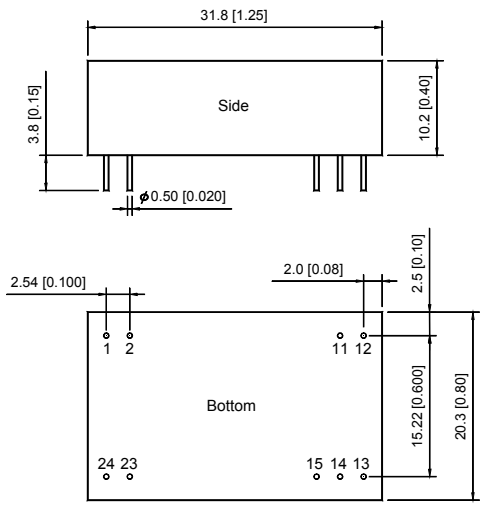

### Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 95° C.

The derating curves are determined from measurements obtained in an experimental apparatus.



## Mechanical Dimensions




| Tolerance | Millimeters | Inches |
|---|---|---|
| | X.X±0.25 | X.XX±0.01 |
| | X.XX±0.13 | X.XXX±0.005 |
| Pin | ±0.05 | ±0.002 |

## Physical Characteristics

**Case Size** : 31.8×20.3×10.2 mm
1.25×0.80×0.40 inches

**Case Material** : Non−Conductive Black Plastic

**Weight** : 12g

**Flammability** : UL94V−0

## Pin Connections

| Pin | Single Output | Dual Output |
|---|---|---|
| 1 | +Vin | +Vin |
| 2 | +Vin | +Vin |
| 11 | +Vout | +Vout |
| 12 | +Vout | +Vout |
| 13 | −Vout | Common |
| 14 | −Vout | Common |
| 15 | No Pin | −Vout |
| 23 | −Vin | −Vin |
| 24 | −Vin | −Vin |