

MKW2500 / MKW2500A Series

15 Watts 2:1 Wide Input Range DC/DC Converters

Single and Dual Outputs

Key Features

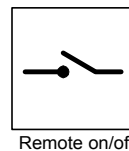
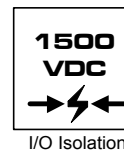
- High Efficiency up to 86%
- 2:1 Input Range
- I/O Isolation 1500VDC
- Short Circuit Protected
- Industry Standard Pinout
- Six-Side Shielded Case
- EMI Complies With EN55002 Class A
(Only For MKW2500A Series)
- Remote on/off Control (Optional)
- MTBF > 700,000 Hours



Minmax's MKW2500 series, comprising 18 different models, has been conceived as an applications specific range of DC/DC converters, specially addressing data communication equipments, mobile battery driven equipments, distributed power systems, telecommunication equipments, mixed analog/digital subsystems, process/machine control equipments, computer peripheral systems and industrial robot systems.

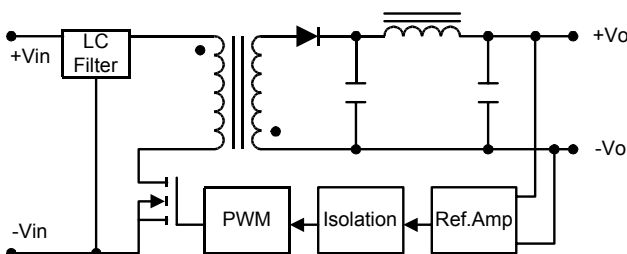
Packing up to 15W of power into a 2 x 1 x 0.4 inch package, with efficiency as high as 86%, the MKW2500 has wide input ranges of 9-18VDC, 18-36VDC and 36-75VDC, and is available in output voltages of 3.3V, 5.1V, 12V, 15V, $\pm 12V$ and $\pm 15V$.

Other features include continuous short circuit protection, remote on/off, six-side shielded case and EN55022 level A conducted noise compliance minimize design-in time, cost and eliminate the need for external components.

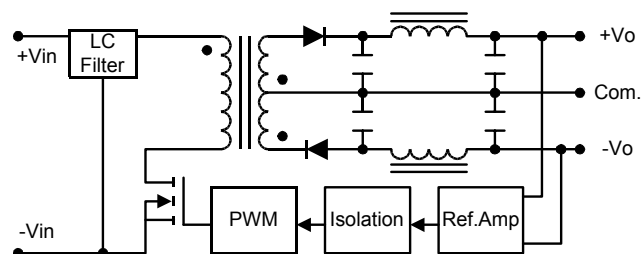


Block Diagram

Single Output



Dual Output



MKW2500 / MKW2500A Series

Model Selection Guide

| Model Number | Input Voltage | Output Voltage | Output Current | | Input Current | | Efficiency |
|--------------|-----------------|----------------|----------------|-------|---------------|-----------|------------|
| | | | Max. | Min. | @Max. Load | @No Load | @Max. Load |
| | VDC | VDC | mA | mA | mA (Typ.) | mA (Typ.) | % (Typ.) |
| MKW2521 | 12 (9 ~ 18) | 3.3 | 3000 | 300 | 1056 | 30 | 78 |
| MKW2522 | | 5.1 | 2950 | 295 | 1529 | | 82 |
| MKW2523 | | 12 | 1250 | 125 | 1452 | | 86 |
| MKW2524 | | 15 | 1000 | 100 | 1452 | | 86 |
| MKW2526 | | ±12 | ±625 | ±62.5 | 1452 | | 86 |
| MKW2527 | | ±15 | ±500 | ±50 | 1452 | | 86 |
| MKW2531 | 24 (18 ~ 36) | 3.3 | 3000 | 300 | 528 | 20 | 78 |
| MKW2532 | | 5.1 | 2950 | 295 | 764 | | 82 |
| MKW2533 | | 12 | 1250 | 125 | 726 | | 86 |
| MKW2534 | | 15 | 1000 | 100 | 726 | | 86 |
| MKW2536 | | ±12 | ±625 | ±62.5 | 726 | | 86 |
| MKW2537 | | ±15 | ±500 | ±50 | 726 | | 86 |
| MKW2541 | 48 (36 ~ 75) | 3.3 | 3000 | 300 | 264 | 10 | 78 |
| MKW2542 | | 5.1 | 2950 | 295 | 382 | | 82 |
| MKW2543 | | 12 | 1250 | 125 | 363 | | 86 |
| MKW2544 | | 15 | 1000 | 100 | 363 | | 86 |
| MKW2546 | | ±12 | ±625 | ±62.5 | 363 | | 86 |
| MKW2547 | | ±15 | ±500 | ±50 | 363 | | 86 |

Absolute Maximum Ratings

| Parameter | Min. | Max. | Unit | |
|--|--------------------|-------|------|-----|
| Input Surge Voltage (1000 mS) | 12VDC Input Models | -0.7 | 25 | VDC |
| | 24VDC Input Models | -0.7 | 50 | VDC |
| | 48VDC Input Models | -0.7 | 100 | VDC |
| Lead Temperature (1.5mm from case for 10 Sec.) | --- | 260 | °C | |
| Internal Power Dissipation | --- | 5,000 | mW | |

Exceeding these values can damage the module. These are not continuous operating ratings.

Note :

- Specifications typical at $T_a=+25^{\circ}\text{C}$, resistive load, nominal input voltage, rated output current unless otherwise noted.
- Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
- Ripple & Noise measurement bandwidth is 0–20 MHz.
- These power converters require a minimum output loading to maintain specified regulation.
- Operation under no-load conditions will not damage these devices; however they may not meet all listed specifications.
- All DC/DC converters should be externally fused at the front end for protection.
- Other input and output voltage may be available, please contact factory.
- To order the converter with Remote on/off function, please add suffix – RC (EX : MKW2521–RC)
- An optional internal filter is available. When the filter is added, the MKW2500 will meet EN55022–A. Add the suffix "A" to the model number, e.g. MKW2521A.
- Specifications subject to change without notice.

Environmental Specifications

| Parameter | Conditions | Min. | Max. | Unit |
|-----------------------|------------------------------|------|------|------|
| Operating Temperature | Ambient | -40 | +60 | °C |
| Operating Temperature | Case | -40 | +100 | °C |
| Storage Temperature | | -50 | +125 | °C |
| Humidity | | --- | 95 | % |
| Cooling | Free–Air Convection | | | |
| RFI | Six–Side Shielded Metal Case | | | |

MKW2500 / MKW2500A Series

Input Specifications

| Parameter | Model | Min. | Typ. | Max. | Unit |
|--------------------------------|------------------|-----------|------|------|------|
| Start Voltage | 12V Input Models | 8 | 8.5 | 9 | VDC |
| | 24V Input Models | 15 | 17 | 18 | |
| | 48V Input Models | 30 | 33 | 36 | |
| Under Voltage Shutdown | 12V Input Models | 7 | 8 | 8.5 | |
| | 24V Input Models | 13 | 15 | 17 | |
| | 48V Input Models | 25 | 29 | 34 | |
| Reverse Polarity Input Current | All Models | --- | --- | 1 | A |
| Short Circuit Input Power | | --- | --- | 3500 | mW |
| Input Filter | | Pi Filter | | | |

Output Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------------------------|--------------------------------|------|------------|------------|---------------|
| Output Voltage Accuracy | | --- | ± 1.0 | ± 2.0 | % |
| Output Voltage Balance | Dual Output Balance Load | --- | ± 0.5 | ± 2.0 | % |
| Line Regulation | $V_{in} = \text{Min. to Max.}$ | --- | ± 0.1 | ± 0.5 | % |
| Load Regulation | $I_o = 10\% \text{ to } 100\%$ | --- | ± 0.5 | ± 1.0 | % |
| Ripple & Noise (20MHz) | | --- | 55 | 80 | mV P-P |
| Ripple & Noise (20MHz) | Over Line, Load & Temp | --- | --- | 100 | mV P-P |
| Ripple & Noise (20MHz) | | --- | --- | 15 | mV rms. |
| Over Power Protection | | 120 | --- | --- | % |
| Transient Recovery Time | 25% Load Step Change | --- | 300 | 500 | μs |
| Transient Response Deviation | | --- | ± 2 | ± 4 | % |
| Temperature Coefficient | | --- | ± 0.01 | ± 0.02 | %/°C |
| Output Short Circuit | Continuous | | | | |

General Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------------------|-------------------------------------|------|------|------|------------|
| Isolation Voltage | 60 Seconds | 1500 | --- | --- | VDC |
| Isolation Test Voltage | Flash Tested for 1 Second | 1650 | --- | --- | VDC |
| Isolation Resistance | 500VDC | 1000 | --- | --- | M Ω |
| Isolation Capacitance | 100KHz, 1V | --- | 1200 | 1500 | pF |
| Switching Frequency | | 290 | 330 | 400 | KHz |
| MTBF | MIL-HDBK-217F @ 25°C, Ground Benign | 700 | --- | --- | K Hours |

Remote On/Off Control

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------|-------------------------------|------|------|------|---------------|
| Supply On | 2.5 to 5.5VDC or Open Circuit | | | | |
| Supply Off | | -0.7 | --- | 0.8 | VDC |
| Standby Input Current | | --- | --- | 10 | mA |
| Control Input Current (on) | | --- | --- | 50 | μA |
| Control Input Current (off) | | --- | --- | -1 | mA |
| Control Common | Referenced to Negative Input | | | | |

MKW2500 / MKW2500A Series

Capacitive Load

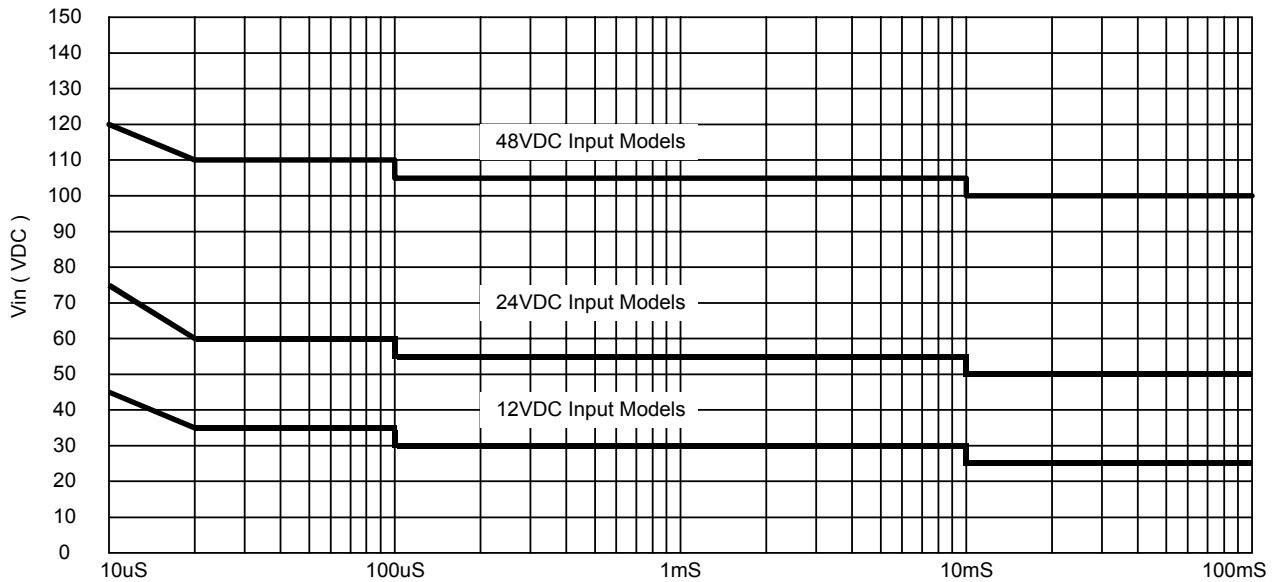
| Models by Vout | 3.3V | 5.1V | 12V | 15V | ±12V # | ±15V # | Unit |
|-------------------------|------|------|-----|-----|--------|--------|------|
| Maximum Capacitive Load | 470 | 470 | 470 | 470 | 220 | 220 | uF |

Note: # For each output .

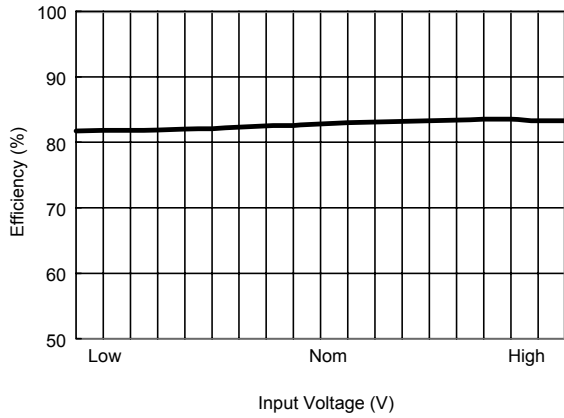
Input Fuse Selection Guide

| 12V Input Models | 24V Input Models | 48V Input Models |
|-------------------------|-------------------------|------------------------|
| 3000mA Slow – Blow Type | 1500mA Slow – Blow Type | 750mA Slow – Blow Type |

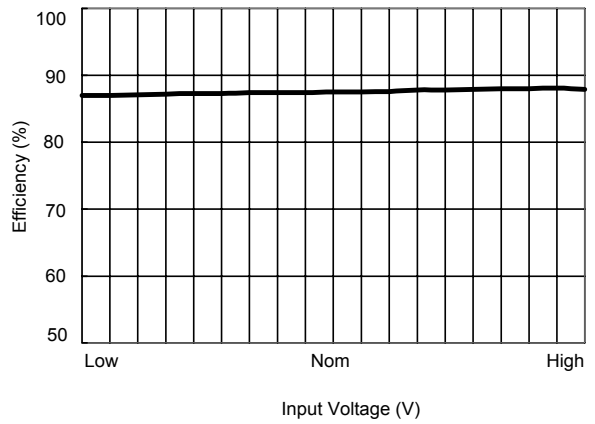
Input Voltage Transient Rating



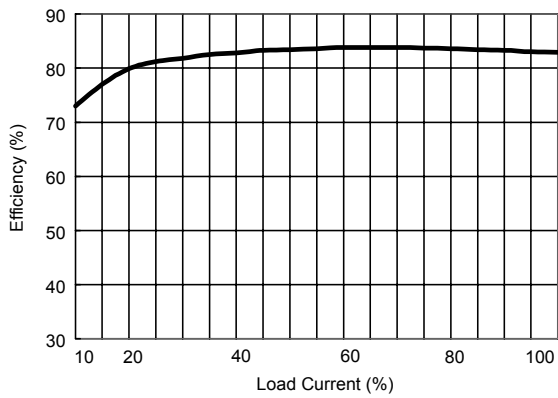
MKW2500 / MKW2500A Series



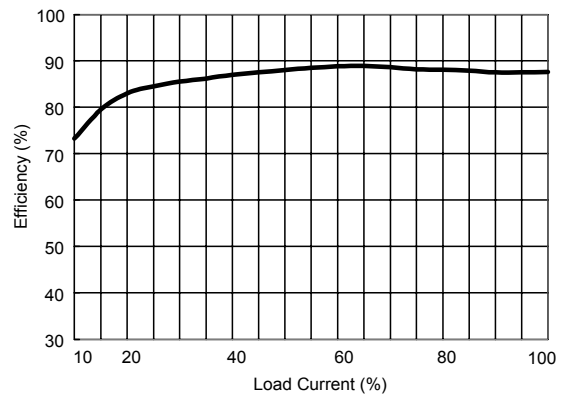
Efficiency vs Input Voltage (Single Output)



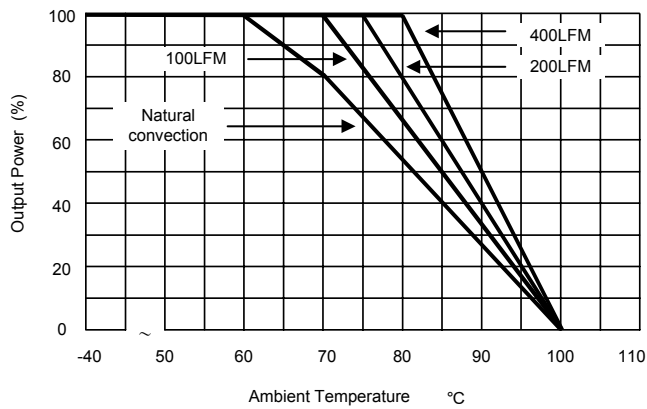
Efficiency vs Input Voltage (Dual Output)



Efficiency vs Output Load (Single Output)



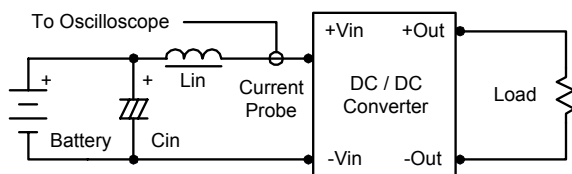
Efficiency vs Output Load (Dual Output)



Derating Curve

Test Configurations

Input Reflected-Ripple Current Test Setup



Input reflected-ripple current is measured with an inductor L_{in} (4.7uH) and C_{in} (220uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance.

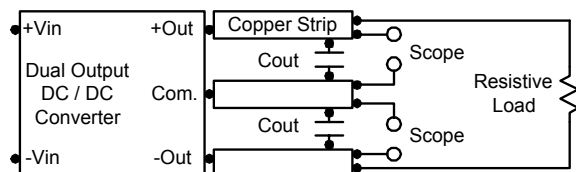
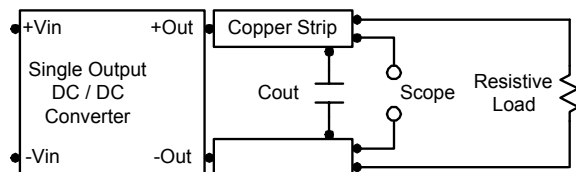
Capacitor C_{in} , offsets possible battery impedance.

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 C_{out} 0.47uF 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

Remote On/Off

Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low.

Negative logic remote on/off turns the module off during a logic low and on during a logic high.

To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the $-V_{in}$ terminal.

The switch can be an open collector or equivalent.

A logic low is $-0.7V$ to $0.8V$.

A logic high is $2.5V$ to $5.5V$.

The maximum sink current at on/off terminal during a logic low is 1 mA.

The maximum allowable leakage current of the switch at on/off terminal = 2.5 to $5.5V$ is 50uA.

Overcurrent Protection

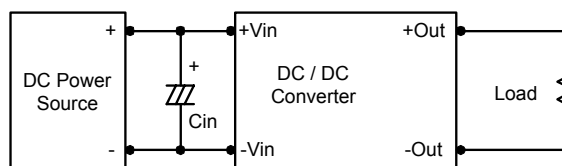
To provide protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure current limiting for an unlimited duration. At the point of current-limit inception, the unit shifts from voltage control to current control. The unit operates normally once the output current is brought back into its specified range.

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.

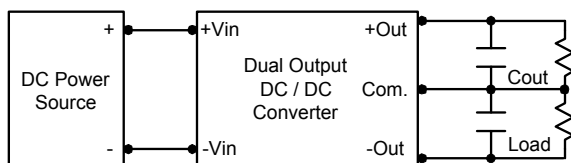
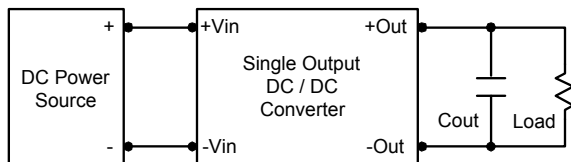
Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 22uF for the 12V input devices and a 6.8uF for the 24V and 48V devices.



Output Ripple Reduction

A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance.

To reduce output ripple, it is recommended to use 4.7uF capacitors at the output.



Maximum Capacitive Load

The MKW2500 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.

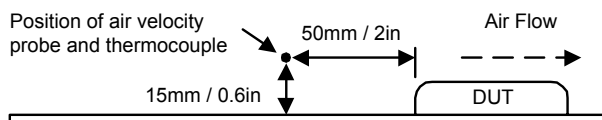
For optimum performance we recommend 220uF maximum capacitive load for dual outputs and 470uF capacitive load for single outputs.

The maximum capacitance can be found in the data.

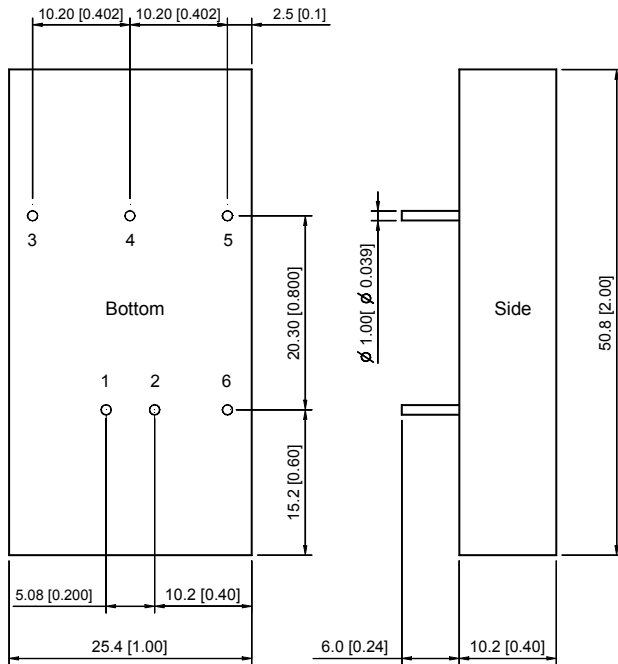
Thermal Considerations

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 100°C.

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



Mechanical Data

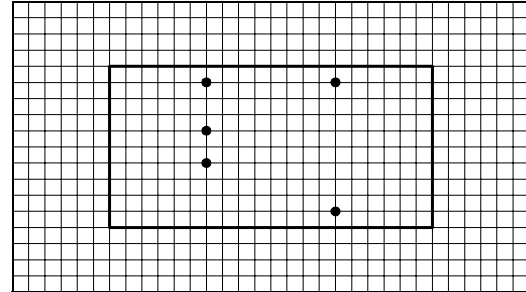


| Tolerance | Millimeters | Inches |
|-----------|-------------|-----------|
| | .X±0.25 | .XX±0.01 |
| | .XX±0.25 | .XXX±0.01 |
| Pin | ±0.05 | ±0.002 |

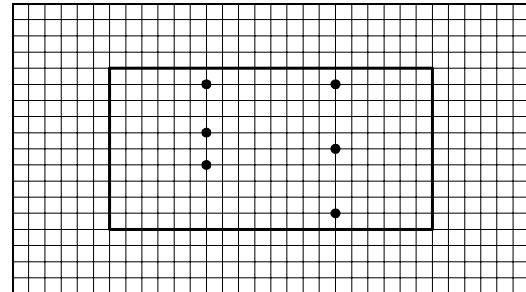
Connecting Pin Patterns

Top View (2.54 mm / 0.1 inch grids)

Single Output



Dual Output



Pin Connections

| Pin | Single Output | Dual Output |
|-----|--------------------------|-------------|
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | +Vout | +Vout |
| 4 | No Pin | Common |
| 5 | -Vout | -Vout |
| 6 | Remote on/off (Optional) | |

Physical Characteristics

| | |
|---------------|---|
| Case Size | : 50.8×25.4×10.2 mm 2.0×1.0×0.4 inches |
| Case Material | : Nickel-Coated Copper With Non-Conductive Baseplate |
| Weight | : 32g |
| Flammability | : UL94V-0 |

Units are encapsulated in a low thermal resistance molding compound which has excellent chemical resistance and electrical properties in high humidity environment and over a wide operating temperature range. The encapsulant and outer shell of the unit have UL94V-0 ratings. The leads are golden plated for better soldering.