

## Features

- Single board design
- Basic Isolation
- Low profile SMT design
- Excellent co-planarity (within 0.1mm)
- Input/output isolation: 1500 Vdc
- High current density
- Output over-current protection
- Full rated output power to 60°C with no airflow
- Operating temperature to 100°C
- Remote shutdown (primary referenced), negative logic option also available
- Output voltage trim adjust, positive or negative
- 8.5mm height
- Basic insulation
- UL, CSA and EN/IEC60950 (3<sup>rd</sup> ed.) approvals pending

## Applications

- Distributed power architectures
- Telecommunications equipment
- LAN/WAN applications
- Data processing
- Industrial applications

## Description

The RDS series of converters are low profile, single output, DC/DC converters intended for SMT placement and reflow soldering. The product provides on-board conversion of standard telecom and datacom input voltages to isolated low output voltages. Proprietary patented manufacturing processes with full process automation ensure optimal product quality. These are very high performance, cost effective converters with a very small PCB footprint.

| Selection Chart   |                    |                         |                     |                           |                                |               |
|-------------------|--------------------|-------------------------|---------------------|---------------------------|--------------------------------|---------------|
| Model             | Input voltage, Vdc | Input current, max, Adc | Output voltage, Vdc | Output rated current, Adc | Output ripple and noise, mVp-p | Efficiency, % |
| <b>RDS06ZB-M6</b> | 36-75              | 0.65                    | 1.8                 | 6.0                       | 75                             | 83            |
| <b>RDS05ZE-M6</b> | 36-75              | 0.65                    | 3.3                 | 5.0                       | 75                             | 83            |
| <b>RDS04ZG-M6</b> | 36-75              | 0.65                    | 5.0                 | 4.0                       | 50                             | 86            |

**RDS Series: 20W DC/DC Converters**  
**36-75V Input**  
**1.8V, 3.3V and 5.0V Outputs**

### Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings may cause performance degradation, adversely affect long term reliability and cause permanent damage to the converter. Specifications apply over specified input voltage, output load and temperature range, unless otherwise noted.

| Parameter                      | Conditions/Description | Min  | Max | Units |
|--------------------------------|------------------------|------|-----|-------|
| Input voltage (Vin)            | Continuous             | 36   | 75  | Vdc   |
| Transient Input Voltage (Vint) | Transient, 100ms       |      | 100 | Vdc   |
| Operating CaseTemp. (Tc)       | At 100% load           | -40  | 100 | °C    |
| Storage Temperature (Ts)       |                        | -55  | 120 | °C    |
| ON/OFF Control Voltage (Vrc)   | Referenced to -Vin     | -1.0 | 5.5 | Vdc   |

### Environmental and Mechanical Specifications

Specifications apply over specified input voltage, output load and temperature range, unless otherwise noted.

| Parameter            | Conditions/Description     | Min | Nom   | Max    | Units |
|----------------------|----------------------------|-----|-------|--------|-------|
| Shock                | IEC68-2-27                 |     |       | 100    | g     |
| Sinusoidal Vibration | IEC68-2-6                  |     |       | 10     | g     |
| Weight               |                            |     |       | 0.6/17 | oz/g  |
| Water Washing        | Standard process           | Yes |       |        | N/A   |
| MTBF                 | Per Bellcore TR-NWT-000332 |     | 2,500 |        | kHrs  |

### Isolation Specifications

Specifications apply over specified input voltage, output load and temperature range, unless otherwise noted.

| Parameter                   | Conditions/Description | Min   | Nom   | Max   | Units |
|-----------------------------|------------------------|-------|-------|-------|-------|
| Insulation Safety Rating    | Vin = 36 – 75Vdc       | Basic |       |       | N/A   |
| Isolation Voltage (Vps)     |                        |       |       | 1,500 | Vdc   |
| Isolation Resistance (Rps)  |                        | 10    |       |       | MOhm  |
| Isolation Capacitance (Cps) |                        |       | 8,200 |       | pF    |

### Input Specifications

Specifications apply over specified input voltage, output load and temperature range, unless otherwise noted.

| Parameter                        | Conditions/Description   | Min | Nom | Max | Units |
|----------------------------------|--|-----|-----|-----|-------|
| Input Voltage (Vin)              | Continuous   | 36  | 48  | 75  | Vdc   |
| Input Current when Shutdown      | Vin.Nom, Remote Control activated                              |     | 3   | 10  | mAdc  |
| Turn-On Input Voltage 36-75 Vin  | Ramping Up, Io.Max   | 32  | 34  | 36  | Vdc   |
| Turn-Off Input Voltage 36-75 Vin | Ramping Down, Io.Max   | 30  | 32  | 34  | Vdc   |
| Turn-On Time                     | To Output Regulation Band<br>After Remote Control<br>Rise Time |     | 600 |     | ms    |
|                                  |  |     | 30  |     | ms    |
|                                  |  |     | 5   |     | ms    |
| Input Reflected Ripple Current   | Vin.Max, Io.Max  |     |     | 50  | mAp-p |
| Input Capacitance                |  |     |     | 1.4 | µF    |

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**36-75V Input**  
**1.8V, 3.3V and 5.0V Outputs**

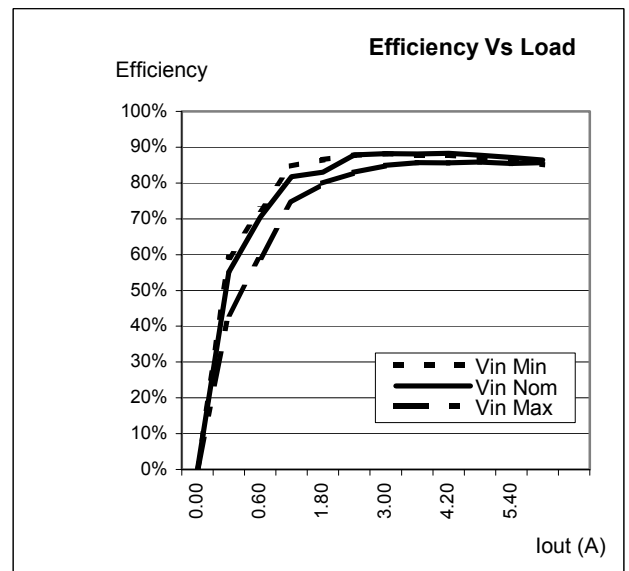
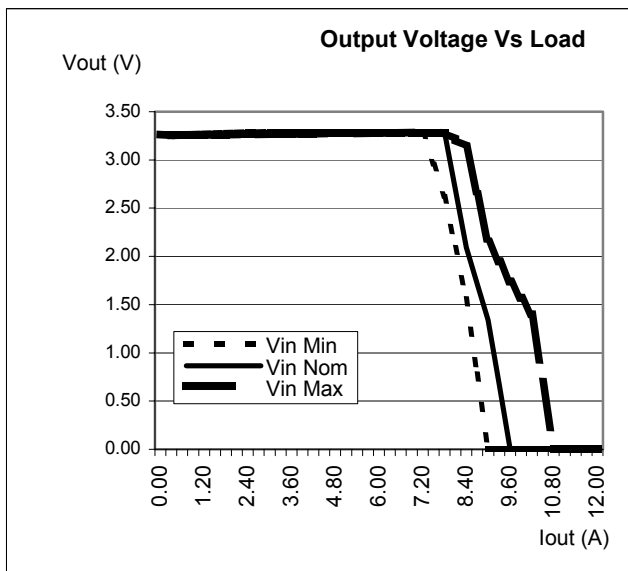
**Output Specifications**

All specifications apply over input voltage, output load and temperature range, unless otherwise noted.

**RDS06ZB : 1.8V/6A**

| Parameter                         |       | Conditions/Description                                | Min  | Nom | Max   | Units   |
|-----------------------------------|-------|---|------|-----|-------|---------|
| Output Voltage Setpoint Accuracy  | Vo    | Vin.Nom, Io = 3.0A, 25°C                              | 1.78 | 1.8 | 1.82  | Vdc     |
| Output Current                    | Io    | Vin.Min to Vin.Max                                    | 0    |     | 6.0   | Adc     |
| Line Regulation                   |       | Vin.Min to Vin.Max, 50% Io.Max                        |      |     | 36    | mV      |
| Load Regulation                   |       | Vin.Nom, Io.Min to Io.Max                             |      |     | 36    | mV      |
| Dynamic Regulation Peak Deviation |       | 50-100% Io.Max load step change.                      |      |     | 150   | ± mV    |
| Settling Time                     |       | to 1% error band                                      |      |     | 500   | µs      |
| Output Voltage Ripple             | Vr    | Vin.Min to Vin.Max, Io.Min to Io Max, 20MHz Bandwidth |      | 75  | 100   | mVp-p   |
| Admissible Load Capacitance       | Comax | Io.Max, Vin.Nom                                       |      |     | 2,200 | µF      |
| Output Current Limit Threshold    | Icl   | Vout ≤ 0.90 Vo.Nom                                    | 120  |     | 200   | %Io.Max |
| Switching Frequency               | Fs    | Vin.Nom, Io.Max                                       |      | 400 |       | kHz     |
| Temperature Coefficient           | Tco   |   |      |     | 0.02  | %Vo/°C  |
| Trim Range                        | Vt    | Io.Min to Io.Max, Vin.Min to Vin.Max                  | 1.62 |     | 1.98  | Vdc     |

**RFS06ZB Characteristic curves**



**RDS Series: 20W DC/DC Converters**  
**36-75V Input**  
**1.8V, 3.3V and 5.0V Outputs**

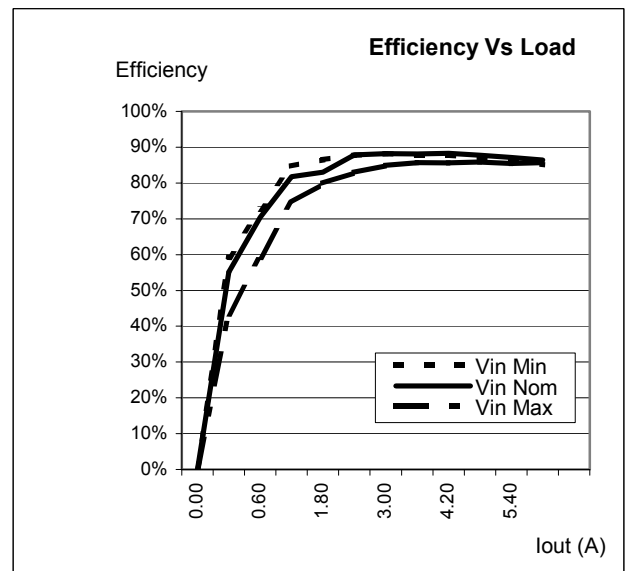
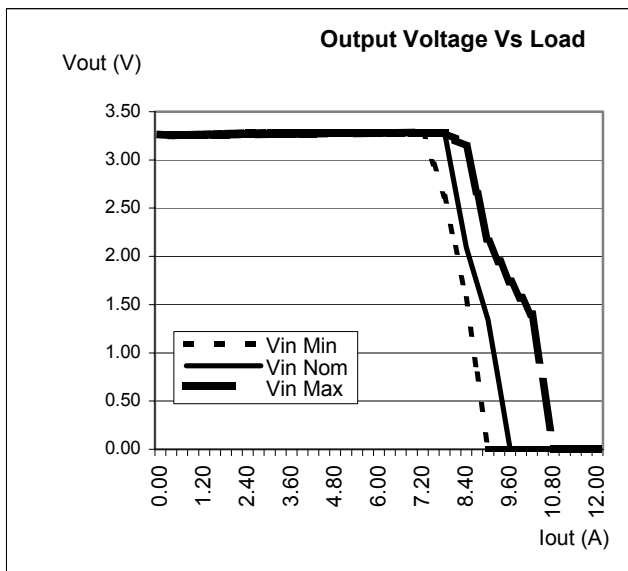
**Output Specifications**

All specifications apply over input voltage, output load and temperature range, unless otherwise noted.

**RDS05ZE : 3.3V/5A**

| Parameter                         |       | Conditions/Description                                | Min  | Nom | Max   | Units   |
|-----------------------------------|-------|---|------|-----|-------|---------|
| Output Voltage Setpoint Accuracy  | Vo    | Vin.Nom, Io = 3.0A, 25°C                              | 3.26 | 3.3 | 3.34  | Vdc     |
| Output Current                    | Io    | Vin.Min to Vin.Max                                    | 0    |     | 5.0   | Adc     |
| Line Regulation                   |       | Vin.Min to Vin.Max, 50% Io.Max                        |      |     | 65    | mV      |
| Load Regulation                   |       | Vin.Nom, Io.Min to Io.Max                             |      |     | 65    | mV      |
| Dynamic Regulation Peak Deviation |       | 50-100% Io.Max load step change.                      |      |     | 150   | ± mV    |
| Settling Time                     |       | to 1% error band                                      |      |     | 500   | µs      |
| Output Voltage Ripple             | Vr    | Vin.Min to Vin.Max, Io.Min to Io Max, 20MHz Bandwidth |      | 75  | 100   | mVp-p   |
| Admissible Load Capacitance       | Comax | Io.Max, Vin.Nom                                       |      |     | 2,200 | µF      |
| Output Current Limit Threshold    | Icl   | Vout ≤ 0.90 Vo.Nom                                    | 120  |     | 200   | %Io.Max |
| Switching Frequency               | Fs    | Vin.Nom, Io.Max                                       |      | 400 |       | kHz     |
| Temperature Coefficient           | Tco   |   |      |     | 0.02  | %Vo/°C  |
| Trim Range                        | Vt    | Io.Min to Io.Max, Vin.Min to Vin.Max                  | 2.97 |     | 3.63  | Vdc     |

**RFS05ZE Characteristic curves**



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**36-75V Input**  
**1.8V, 3.3V and 5.0V Outputs**

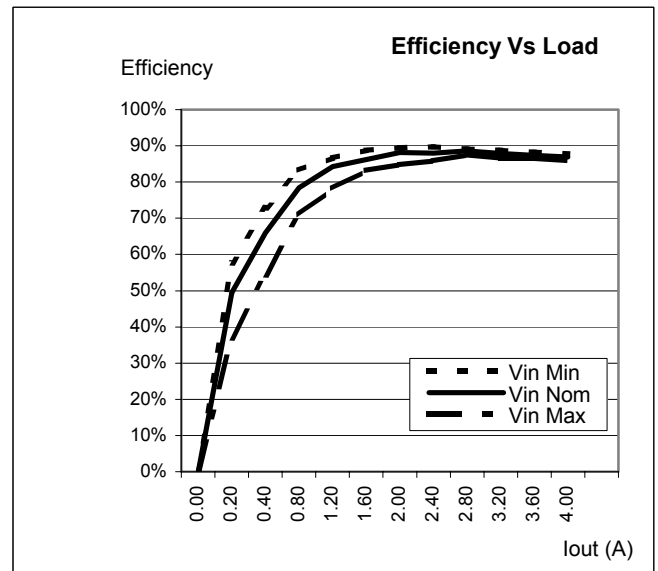
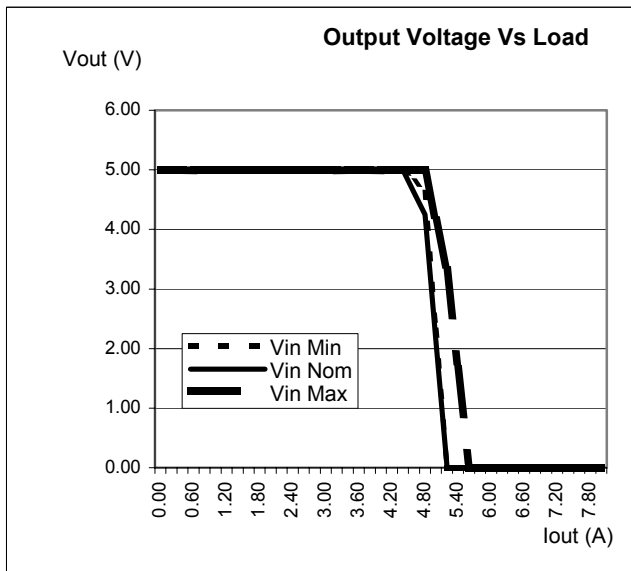
**Output Specifications**

All specifications apply over input voltage, output load and temperature range, unless otherwise noted.

**RDS04ZG : 5.0V/4.0A**

| Parameter                         |       | Conditions/Description                                | Min  | Nom | Max   | Units   |
|-----------------------------------|-------|---|------|-----|-------|---------|
| Output Voltage Setpoint Accuracy  | Vo    | Vin.Nom, Io = 2.0 A, 25°C                             | 4.94 | 5.0 | 5.06  | Vdc     |
| Output Current                    | Io    | Vin.Min to Vin.Max                                    | 0    |     | 4.0   | Adc     |
| Line Regulation                   |       | Vin.Min to Vin.Max, 50% Io.Max                        |      |     | 100   | mV      |
| Load Regulation                   |       | Vin.Nom, Io.Min to Io.Max                             |      |     | 100   | mV      |
| Dynamic Regulation Peak Deviation |       | 50-100% Io.Max load step change.                      |      |     | 250   | ± mV    |
| Settling Time                     |       | to 1% error band                                      |      |     | 500   | µs      |
| Output Voltage Ripple             | Vr    | Vin.Min to Vin.Max, Io.Min to Io Max, 20MHz Bandwidth |      | 50  | 100   | mVp-p   |
| Admissible Load Capacitance       | Comax | Io.Max, Vin.Nom                                       |      |     | 2,200 | µF      |
| Output Current Limit Threshold    | Icl   | Vout ≤ 0.90 Vo.Nom                                    | 120  |     | 200   | %Io.Max |
| Switching Frequency               | Fs    | Vin.Nom, Io.Max                                       |      | 400 |       | kHz     |
| Temperature Coefficient           | Tco   |   |      |     | 0.02  | %Vo/°C  |
| Trim Range                        | Vt    | Io.Min to Io.Max, Vin.Min to Vin.Max                  | 4.5  |     | 5.5   | Vdc     |

**RDS04ZG Characteristic curves**



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**36-75V Input**  
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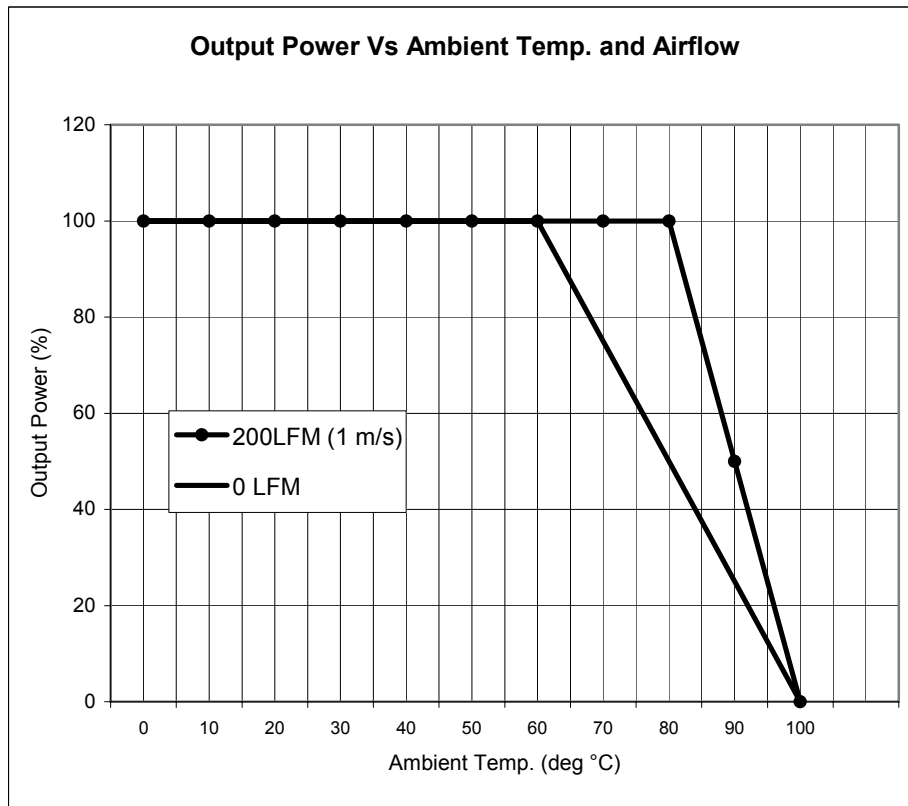
**Feature Specifications**

All specifications apply over input voltage, output load and temperature range, unless otherwise noted.

| Parameter             | Conditions/Description                        | Min  | Nom | Max  | Units |
|-----------------------|---|------|-----|------|-------|
| Shutdown (ON/OFF)     |   |      |     |      |       |
| <b>POSITIVE LOGIC</b> | <b>On/Off signal is low– converter is OFF</b> |      |     |      |       |
| Converter ON          | High logic range                              | 2.5  |     | 5.5  | Vdc   |
| Converter OFF         | Shutdown pin is pulled low                    | -1.0 |     | 1.0  | Vdc   |
| <b>NEGATIVE LOGIC</b> | <b>On/Off signal is low– converter is ON</b>  |      |     |      |       |
| Converter ON          | Low logic range                               | -1.0 |     | 0.25 | Vdc   |
| Converter OFF         | Shutdown pin is pulled high                   | 1.0  |     | 5.5  | Vdc   |

**Temperature Derating Curves**

The derating curves below give an indication of the output power achievable with and without forced air cooling. However in the final application, in order to ensure the reliability of the unit, care must be taken to ensure the maximum case temperature is not exceeded under any conditions.



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**36-75V Input**  
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### Typical Application

This series of converters does not require any external components for proper operation. However, if the distribution of the input voltage to the converter contains significant inductance, a capacitor across the input terminals may be required to stabilize the input voltage. A minimum of 1µF, quality electrolytic / ceramic capacitor is recommended for this purpose.

For output decoupling it is recommend connecting a 1µF ceramic capacitor directly across the output pins of the converter.

### Shutdown Feature

The remote control pin functions as a normal soft shutdown. It is referenced to the -Vin pin. With positive logic, when the remote control pin is pulled low, the output is turned off and the unit goes into a very low input power mode.

An open collector switch is recommended to control the voltage between the shutdown pin and the -Vin pin of the converter. The remote control pin is pulled up internally, so no external voltage source is required. The user should avoid connecting a resistor between the shutdown pin and +Vin pin.

Care must be taken to ensure that the pin reference for the control is connected close to the -Vin pin. The control signal must not be referenced ahead of EMI filtering, or remotely from the unit. If the remote control pin is not used, it can be left floating.

### Negative Logic (excludes shut down)

The output of the converter may be enabled or disabled by means of a logic signal (TTL, CMOS, etc.) applied to the shutdown pin. No output voltage overshoot will occur when the unit is turned on. If the function is not required the pin should be connected to -Vin to enable the output .

### Thermal Considerations

The converter is designed for natural or forced convection cooling. The output power of the converter is limited by the maximum case temperature (Tc). To ensure reliable long term operation of the converters, and to comply with safety agency requirements, Power-One limits maximum allowable case temperature (Tc) to 100°C (see Mechanical Drawings).

### Output Current Limiting

When the output is overloaded above the maximum output current rating, the voltage will start to reduce to maintain the output power to a safe level. In a condition of high overload or short-circuit where the output voltage is pulled below approximately 30% of Vo.Nom, the unit will enter a 'Hiccup' mode of operation. Under this condition the unit will attempt to restart, approximately every 25ms until the overload has cleared.

### Parallel Operation

Paralleling of two converters is not possible.

### Output Voltage Trim

The trim feature allows the user to adjust the output voltage from the nominal.

Output voltage can be adjusted by an external resistor. To increase Vo a resistor should be connected between pins 2 and 3. To decrease Vo a resistor should be connected between pins 1 and 3.

To **increase** Vo:

$$R_{ext} = (A - (D \times V_{out})) / (V_{out} - V_{out.Nom})$$

To **reduce** Vo:

$$R_{ext} = ((B \times V_{out}) - C) / (V_{out.Nom} - V_{out})$$

Where Vout is the desired output voltage

| Model   | A     | B    | C     | D    |
|---------|-------|------|-------|------|
| RDS05ZA | 1945  | 1470 | 1944  | 470  |
| RDS05ZB | 2590  | 1730 | 2560  | 750  |
| RDS05ZB | 5010  | 2516 | 5010  | 1500 |
| RDS04ZE | 7010  | 3161 | 7010  | 1500 |
| RDS03ZG | 11260 | 4532 | 11240 | 1500 |

### Note:

When the output voltage is trimmed up, the output power from the converter must not exceed its maximum rating. This is determined by measuring the voltage on the output pins, and multiplying it by the output current.



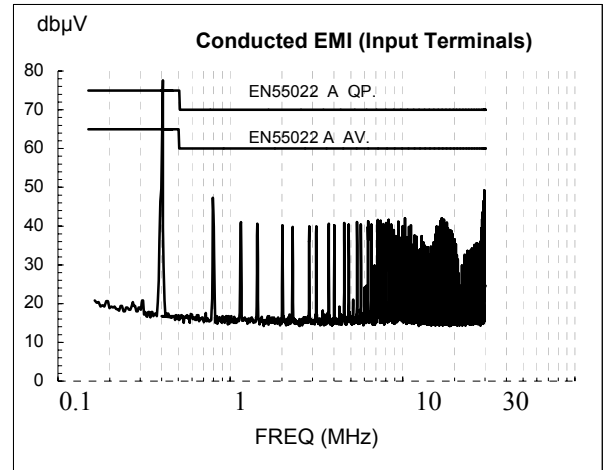
### Safety Considerations

These converters feature 1500 Volt DC isolation from input to output. The input to output resistance is greater than 10M $\Omega$ . These converters are provided with Basic Insulation between input and output circuits according to EN60950 / UL1950 / CSA60950-00. Nevertheless, if the system using the converter needs to receive safety agency approval, certain rules must be followed in the design of the system. In particular, all of the creepage and clearance requirements of the end-use safety requirements must be observed. These documents include UL60950, CSA60950-00 and EN60950, although specific applications may have additional requirements.

In order for the output of the converter to be considered as SELV (Safety Extra Low Voltage) or TNV-1, according to EN60950 / UL1950 / CSA60950-00, one of the following requirements must be met in the system design:

- The converter has no internal fuse. An external fuse must be provided to protect the system from catastrophic failure. A fuse with a rating not greater than 2.0A is recommended. The user can select a lower rating fuse based upon the inrush transient and the maximum input current of the converter, which occurs at the minimum input voltage. Both input traces and the chassis ground trace (if applicable) must be capable of conducting a current of 1.5 times the value of the fuse without opening. The fuse must not be placed in the grounded input line, if any.
- If the voltage source feeding the module is SELV, the output of the converter is considered SELV and may be grounded or ungrounded.
- The circuitry of the converter may generate transients, which exceed the input voltage. Even if the input voltage is SELV (<60V) the components on the primary side of the converter may have to be considered as hazardous. A safety interlock may be needed to prevent the user from accessing the converter while operational.

### EMC Specifications



#### Conducted Noise:

The converters may require a single capacitor to meet the requirements of level A and level B of EN55022, CISPR22 and FCC CFR title 47 Part 15 Sub-part J - Conducted (conducted noise on the input terminals)

#### Electromagnetic Susceptibility:

| Standard                                 | Applied Stress   | Class Level | Performance Outcome * |
|--|------------------|-------------|-----------------------|
| Electrostatic Discharge<br>EN61000-4-2   | 2KV to pins      | 1           | B                     |
| Electromagnetic Field<br>EN61000-4-3     | 3V/m             | 2           | A                     |
| Electrical Fast Transient<br>EN61000-4-4 | 2000 Vp to input | 3           | B                     |
| Conducted Disturbances<br>EN61000-4-6    | 3Vrms to input   | 2           | B                     |

\* **A** denotes normal operation, no deviation from specification. **B** denotes temporary deviation from specification is possible.



## Surface Mount Assembly

### Soldering:

The following instructions must be observed when soldering the unit. Failure to observe these instructions may result in failure or significant degradation of the module performance. Power-One will not honor any warranty claims arising from failure to observe these instructions.

This product is approved for forced convection reflow soldering only.

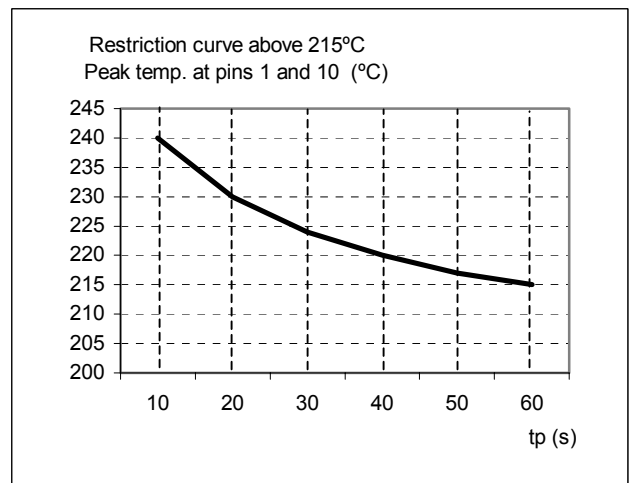
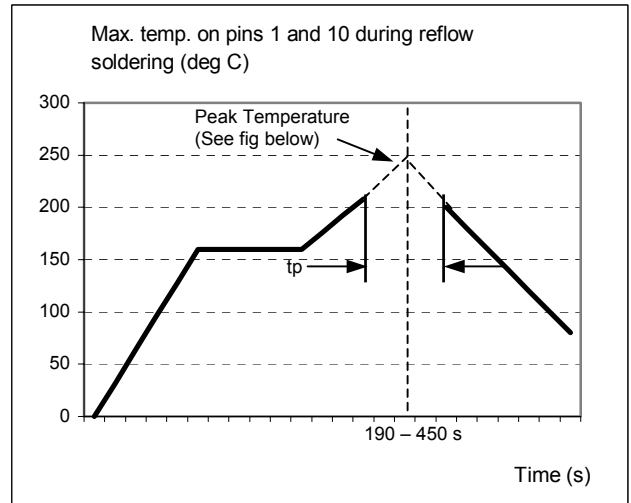
The curves below define the maximum peak reflow temperature permissible measured on Pins 1 and 10 of the converter.

The lead-frame is constructed from a high temperature glass filled, UL94V0 flame retardant, diallyl ortho-phthalate moulding compound commonly used for packaging of electronics components. It has passed NASA outgassing tests and is certified to MIL-M-14. The coefficient of thermal expansion is equivalent to FR4.

The gull wing leads are formed to ensure optimal solder joint strength and structure. Furthermore they facilitate visual inspection (manual or automatic). The leads are formed from a 97% Cu alloy plated with Cu and Sn 90. This material is commonly used in the manufacture of integrated circuits. It has good corrosion resistance and exhibits the nobility inherent to all high copper alloys. Unlike brasses, this material is essentially immune to stress corrosion cracking. It also exhibits excellent solderability. It is readily wetted by solders and performs well in standard solderability tests. (Dip of Class II or better).

The product is manufactured with a patented process, which is fully automated, and 'in-line'. This ensures that there is no contamination or mechanical stress on the lead-frame so that the co-planarity and solderability are maintained.

The product is shipped in JEDEC trays to guarantee preservation of the co-planarity and enable fully automated assembly in the final application (within 0.1mm).

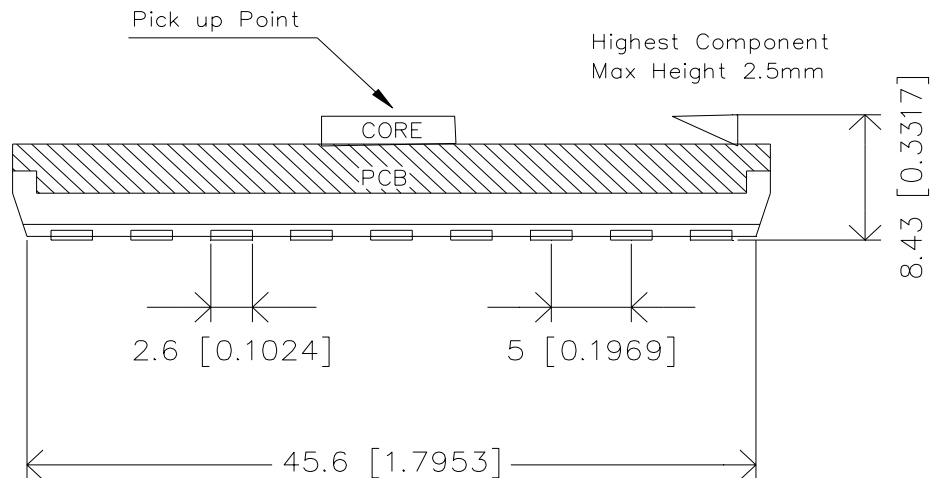
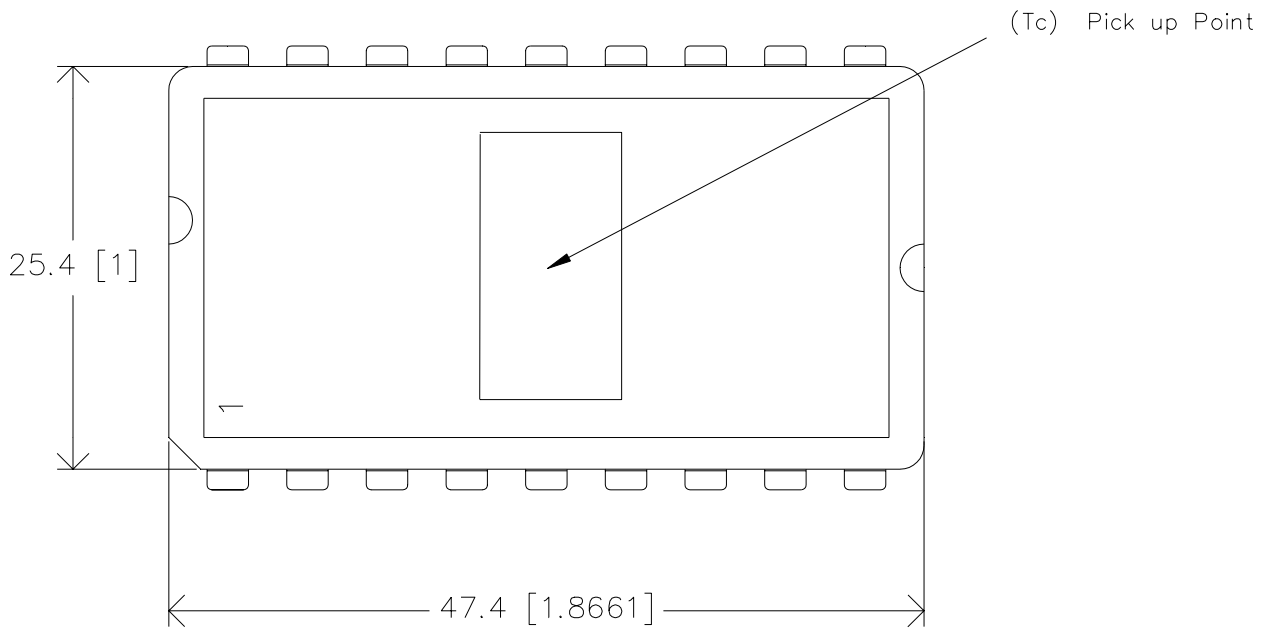


### Pick & Place Assembly:

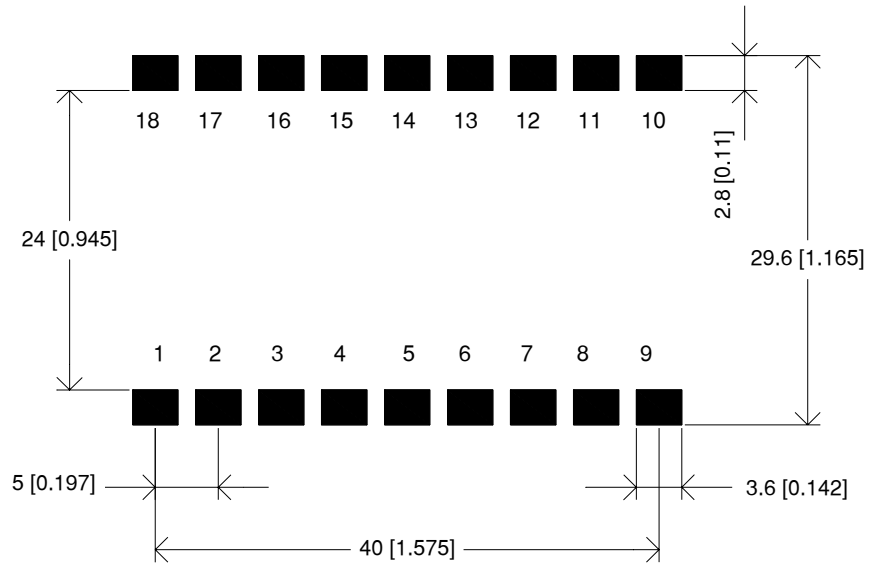
The product is designed with a large flat area in the center of the top surface to serve as a pick up point for automated vacuum pick and place equipment. The 'open board' construction of the unit ensures that weight is kept to a minimum. However due to the relatively large size of the component, a large nozzle (> 4.0mm, depending on vacuum pressure) is recommended for picking and placing. The unit may also be automatically handled using 'odd-form' placement equipment, with mechanical grippers. For this type of equipment the end edges of the device, which have no leads and also feature the greatest dimensional accuracy, should be used as pick-up points.

**Mechanical Drawings**

Note:- mm[inches]  
Tolerances: -  
**0.5-10 ±0.1**  
**10-100 ±0.2**



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**Recommended land pattern**

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### Pin-Out

| Pin | Designation | Function                                    | Reference |
|-----|-------------|---|-----------|
| 1   | +Vout       | Positive output voltage                     | Secondary |
| 2   | -Vout       | Output voltage return                       | Secondary |
| 3   | Trim        | Output voltage adjust                       | Secondary |
| 4   | NC          | No connection                               | Secondary |
| 5   | NC          | No connection                               | Primary   |
| 6   | NC          | No connection                               | Primary   |
| 7   | NC          | No connection                               | Primary   |
| 8   | NC          | No connection                               | Primary   |
| 9   | NC          | No connection                               | Primary   |
| 10  | NC          | No connection                               | Primary   |
| 11  | Shutdown    | Shutdown control. Pull low to turn unit off | Primary   |
| 12  | NC          | No connection                               | Primary   |
| 13  | NC          | No connection                               | Primary   |
| 14  | NC          | No connection                               | Primary   |
| 15  | NC          | No connection                               | Primary   |
| 16  | NC          | No connection                               | Primary   |
| 17  | -Vin        | Input voltage return                        | Primary   |
| 18  | +Vin        | Positive input voltage                      | Primary   |

### Ordering Information

| Options                                      | Suffixes to add to part number                   |
|--|--|
| Negative shutdown logic                      | Add suffix -N (consult factory for availability) |
| Surface Mount Version, shipped in JEDEC Tray | Add Suffix "-M6".                                |
| Dual outputs                                 | Consult factory for availability.                |
| 24V input version                            | Consult factory for availability.                |

Example:- RDS05ZB-NM6 is a surface mount version of the 1.8Vdc output unit with negative logic for shutdown

### Notes

1. Consult factory for the complete list of available options.
2. Power-One products are not authorized for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems without the express written consent of the President of Power-One, Inc.
3. Specifications are subject to change without notice.