



### FEATURES

- Efficiency up to 80%
- SIP Package with Standard Pinout
- Fully Regulated Output
- Operating Temperature Range -40°C to +85°C
- Ultra-wide 4:1 Input Range
- Isolation Voltage 1500 VDC
- Short circuit protection
- Lead free, RoHs compliant
- 3 Years Product Warranty



The PH02S/D series are miniature, SIP Package, isolated 2W DC/DC converters with 1,500VDC isolation. The PH02S/D series features fully regulated output and wide 4:1 input voltage ranges. The most convenient advantage is the modules with a small footprint occupying only 2.4 cm<sup>2</sup> (0.36 square in.) on the PCB. It offers short circuit protection and allows a wide operating temperature range of -40°C to +85°C. These isolated DC/DC converters are the latest offering from a world leader in power systems technology and manufacturing — Delta Electronics, Inc

### Model List

| Model Number | Input Voltage (Range)<br>VDC | Output Voltage<br>VDC | Output Current |            | Input Current          |                      | Reflected Ripple Current<br>mA(typ.) | Max. capacitive Load<br>uF | Efficiency (typ.)<br>@Max. Load<br>% |
|--------------|------------------------------|-----------------------|----------------|------------|------------------------|----------------------|--------------------------------------|----------------------------|--------------------------------------|
|              |                              |                       | Max.<br>mA     | Min.<br>mA | @Max. Load<br>mA(typ.) | @No Load<br>mA(typ.) |                                      |                            |                                      |
|              |                              |                       |                |            |                        |                      |                                      |                            |                                      |
| PH02S2403A   | 24<br>(9 ~ 36)               | 3.3                   | 500            | 125        | 97                     | 20                   | 300                                  | 2200                       | 71                                   |
| PH02S2405A   |                              | 5                     | 400            | 100        | 110                    |                      |                                      | 1000                       | 76                                   |
| PH02S2412A   |                              | 12                    | 167            | 42         | 106                    |                      |                                      | 170                        | 79                                   |
| PH02S2415A   |                              | 15                    | 134            | 33         | 105                    |                      |                                      | 110                        | 80                                   |
| PH02D2405A   |                              | ±5                    | ±200           | ±50        | 114                    |                      |                                      | 470*                       | 73                                   |
| PH02D2412A   |                              | ±12                   | ±83            | ±21        | 108                    |                      |                                      | 100*                       | 77                                   |
| PH02D2415A   |                              | ±15                   | ±67            | ±17        | 106                    |                      |                                      | 47*                        | 79                                   |
| PH02S4803A   |                              | 48<br>(18 ~ 75)       | 3.3            | 500        | 125                    |                      |                                      | 49                         | 15                                   |
| PH02S4805A   | 5                            |                       | 400            | 100        | 58                     | 1000                 | 72                                   |                            |                                      |
| PH02S4812A   | 12                           |                       | 167            | 42         | 54                     | 170                  | 78                                   |                            |                                      |
| PH02S4815A   | 15                           |                       | 134            | 33         | 54                     | 110                  | 78                                   |                            |                                      |
| PH02D4805A   | ±5                           |                       | ±200           | ±50        | 60                     | 470*                 | 70                                   |                            |                                      |
| PH02D4812A   | ±12                          |                       | ±83            | ±21        | 55                     | 100*                 | 76                                   |                            |                                      |
| PH02D4815A   | ±15                          |                       | ±67            | ±17        | 55                     | 47*                  | 76                                   |                            |                                      |

\* For each output

## Input Characteristics

| Parameter                         | Model            | Min.           | Typ. | Max. | Unit |
|-----------------------------------|------------------|----------------|------|------|------|
| Input Surge Voltage (1 sec. max.) | 24V Input Models | -0.7           | ---  | 50   | VDC  |
|                                   | 48V Input Models | -0.7           | ---  | 100  |      |
| Start-Up Voltage                  | 24V Input Models | 4.5            | 6    | 8.5  |      |
|                                   | 48V Input Models | 8.5            | 12   | 17   |      |
| Under Voltage Shutdown            | 24V Input Models | ---            | ---  | 8    |      |
|                                   | 48V Input Models | ---            | ---  | 16   |      |
| Reverse Polarity Input Current    | All Models       | ---            | ---  | 0.5  | A    |
| Short Circuit Input Power         |                  | ---            | ---  | 1500 | mW   |
| Input Filter                      |                  | Capacitor type |      |      |      |
| Internal Power Dissipation        |                  | ---            | ---  | 2500 | mW   |

## Output Characteristics

| Parameter                    | Conditions                  | Min. | Typ.  | Max.  | Unit              |
|------------------------------|-----------------------------|------|-------|-------|-------------------|
| Output Voltage Accuracy      |                             | ---  | ±1.0  | ±2.0  | %                 |
| Output Voltage Balance       | Dual Output, Balanced Loads | ---  | ±1.0  | ±2.0  | %                 |
| Line Regulation              | Vin=Min. to Max.            | ---  | ±0.3  | ±0.5  | %                 |
| Load Regulation              | Io=25% to 100%              | ---  | ±0.5  | ±0.75 | %                 |
| Ripple & Noise (20MHz)       |                             | ---  | 30    | 50    | mV <sub>P-P</sub> |
| Ripple & Noise (20MHz)       | Over Line, Load & Temp.     | ---  | ---   | 75    | mV <sub>P-P</sub> |
| Ripple & Noise (20MHz)       |                             | ---  | ---   | 15    | mV <sub>rms</sub> |
| Transient Recovery Time      | 25% Load Step Change        | ---  | 100   | 300   | µs                |
| Transient Response Deviation |                             | ---  | ±3    | ±5    | %                 |
| Temperature Coefficient      |                             | ---  | ±0.01 | ±0.02 | %/°C              |
| Output Short Circuit         | Continuous                  |      |       |       |                   |

## General Characteristics

| Parameter                     | Conditions                        | Min.      | Typ. | Max. | Unit  |
|-------------------------------|-----------------------------------|-----------|------|------|-------|
| I/O Isolation Voltage (rated) | 60 Seconds                        | 1500      | ---  | ---  | VDC   |
| I/O Isolation Resistance      | 500 VDC                           | 1000      | ---  | ---  | MΩ    |
| I/O Isolation Capacitance     | 100KHz, 1V                        | ---       | 250  | 500  | pF    |
| Switching Frequency           |                                   | ---       | 300  | ---  | KHz   |
| MTBF (Calculated)             | MIL-HDBK-217F@25°C, Ground Benign | 1,000,000 | ---  | ---  | Hours |

## Recommended Input Fuse

| 24V Input Models     | 48V Input Models     |
|----------------------|----------------------|
| 350mA Slow-Blow Type | 135mA Slow-Blow Type |

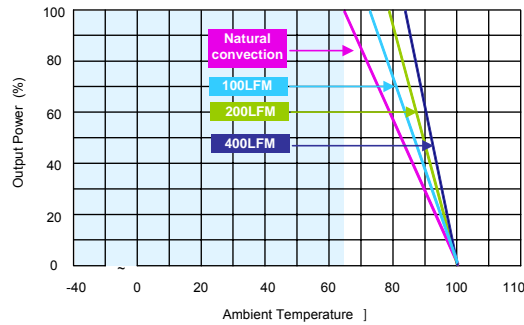
## Remote On/Off Control

| Parameter                     | Conditions  | Min. | Typ. | Max. | Unit |
|-------------------------------|---|------|------|------|------|
| Converter On                  | Under 0.6 VDC or Open Circuit, drops down to 0VDC by 2mV/°C |      |      |      |      |
| Converter Off                 | 2.9 to 15 VDC   |      |      |      |      |
| Standby Input Current         |   | ---  | 1    | 3    | mA   |
| Control Input Current ( on )  | Vin = 0V  | ---  | ---  | -1   | mA   |
| Control Input Current ( off ) | Vin = 5.0V  | ---  | ---  | 1    | mA   |
| Control Common                | Referenced to Negative Input                                |      |      |      |      |

## Environmental Specifications

| Parameter                                   | Conditions          | Min. | Max. | Unit     |
|---|---------------------|------|------|----------|
| Operating Temperature Range (with Derating) | Ambient             | -40  | +85  | °C       |
| Case Temperature                            |                     | ---  | +90  | °C       |
| Storage Temperature Range                   |                     | -55  | +105 | °C       |
| Humidity (non condensing)                   |                     | ---  | 95   | % rel. H |
| Cooling                                     | Free-Air convection |      |      |          |
| Lead Temperature (1.5mm from case for       |                     | ---  | 260  | °C       |

## Power Derating Curve

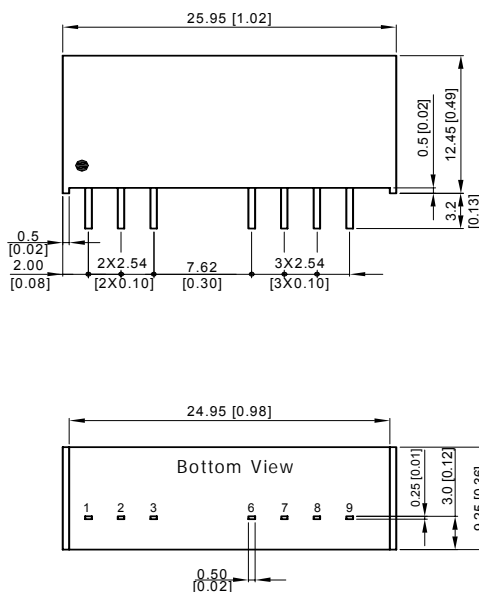


## Notes

- 1 Specifications typical at  $T_a=+25^{\circ}\text{C}$ , resistive load, nominal input voltage and rated output current unless otherwise noted.
- 2 Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
- 3 Ripple & Noise measurement bandwidth is 0-20 MHz.
- 4 These power converters require a minimum output loading to maintain specified regulation, operation under no-load conditions will not damage these modules; however, they may not meet all specifications listed.
- 5 All DC/DC converters should be externally fused at the front end for protection.
- 6 Specifications subject to change without notice.

## Mechanical Drawing

### Mechanical Dimensions



### Pin Connections

| Pin | Single Output | Dual Output |
|-----|---------------|-------------|
| 1   | -Vin          | -Vin        |
| 2   | +Vin          | +Vin        |
| 3   | Remote        | Remote      |
| 6   | +Vout         | +Vout       |
| 7   | NC            | Common      |
| 8   | NC            | NC          |
| 9   | -Vout         | -Vout       |

NC: No Connection

- ▶ All dimensions in mm (inches)
- ▶ Tolerance:  $X.X \pm 0.5$  ( $X.XX \pm 0.02$ )  
 $X.XX \pm 0.25$  ( $X.XXX \pm 0.01$ )
- ▶ Pins  $\pm 0.1$  ( $\pm 0.004$ )

## Physical Outline

|               |   |
|---------------|---|
| Case Size     | : 25.95x9.25x12.45 mm (1.02x0.36x0.49 inches)                   |
| Case Material | : Non-Conductive Black Plastic (flammability to UL 94V-0 rated) |
| Weight        | : 6.5g  |



| Part Numbering System |               |       |                   |               |                |                    |
|-----------------------|---------------|-------|-------------------|---------------|----------------|--------------------|
| P                     | H             | 02    | S                 | 24            | 05             | A                  |
| Form factor           | Family series | Watt  | Number of Outputs | Input Voltage | Output Voltage | Option Code        |
| D-DIP                 | A~Z           | 01:1W | S - Single        | 03:3.3V       | 03:3.3V        | A - Std. Functions |
| P-SIP                 |               | 02:2W | D- Dual           | 05: 5V        | 05: 5V         |                    |
| S-SMD                 |               | 03:3W |                   | 12:12V        | 12:12V         |                    |
|                       |               | 04:4W |                   | 24: 24V       | 15: 15V        |                    |
|                       |               | 06:6W |                   | 48:48V        | 24: 24V        |                    |

### WARRANTY

Delta offers a three (3) years limited warranty. Complete warranty information is listed on our web site or is available upon request from Delta.

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