


**DESCRIPTION: 2W 3KVDC Isolated Single & Dual Output DC/DC Converters**

The TPH series are miniature, isolated 2W DC/DC converters in a SIP and DIP package. They offer the ideal solution in many space critical applications for board level power distribution. The internal SMD construction makes it possible to offer a product with high performance at low cost. The series offers smaller size, improved efficiency, lower output ripple noise and 3KVDC isolation.

**FEATURES**

|                                             |                                                                                           |                                           |
|---------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------|
| RoHS compliant                              | Efficiency up to 86%                                                                      | Power density up to 1.44W/cm <sup>3</sup> |
| Operating temperature: -40°C to 105°C       | Dual output from a single input rail                                                      | UL 94V-0 package material                 |
| Power sharing on output                     | 3KVDC isolation                                                                           | Industry standard pinout                  |
| Input voltage: 3.3V, 5V, 12V, 15V, 24V, 48V | Output voltage: $\pm 5V, \pm 9V, \pm 12V, \pm 15V, \pm 24V$ / 3.3V, 5V, 9V, 12V, 15V, 24V | CE certification                          |

**SELECTION GUIDE**

| Part Number | Nominal Input Voltage | Output Voltage | Output Current (Max./Min) | Efficiency | Package Style |
|-------------|-----------------------|----------------|---------------------------|------------|---------------|
|             | V                     | V              | mA                        | %          |               |
| TPH0505D    | 5                     | $\pm 5$        | $\pm 200/\pm 20$          | 80         | DIP           |
| TPH0509D    | 5                     | $\pm 9$        | $\pm 110/\pm 11$          | 80         | DIP           |
| TPH0512D    | 5                     | $\pm 12$       | $\pm 84/\pm 8.4$          | 81         | DIP           |
| TPH0515D    | 5                     | $\pm 15$       | $\pm 68/\pm 6.8$          | 84         | DIP           |
| TPH0505S    | 5                     | $\pm 5$        | $\pm 200/\pm 20$          | 80         | SIP           |
| TPH0509S    | 5                     | $\pm 9$        | $\pm 110/\pm 11$          | 80         | SIP           |
| TPH0512S    | 5                     | $\pm 12$       | $\pm 84/\pm 8.4$          | 82         | SIP           |
| TPH0515S    | 5                     | $\pm 15$       | $\pm 68/\pm 6.8$          | 83         | SIP           |
| TPH0524S    | 5                     | $\pm 24$       | $\pm 42/\pm 4.2$          | 84         | SIP           |
| TPH1205D    | 12                    | $\pm 5$        | $\pm 200/\pm 20$          | 80         | DIP           |
| TPH1209D    | 12                    | $\pm 9$        | $\pm 110/\pm 11$          | 83         | DIP           |
| TPH1212D    | 12                    | $\pm 12$       | $\pm 84/\pm 8.4$          | 84         | DIP           |
| TPH1215D    | 12                    | $\pm 15$       | $\pm 68/\pm 6.8$          | 86         | DIP           |
| TPH1224D    | 12                    | $\pm 24$       | $\pm 42/\pm 4.2$          | 85         | SIP           |
| TPH1205S    | 12                    | $\pm 5$        | $\pm 200/\pm 20$          | 80         | SIP           |
| TPH1209S    | 12                    | $\pm 9$        | $\pm 110/\pm 11$          | 83         | SIP           |
| TPH1212S    | 12                    | $\pm 12$       | $\pm 84/\pm 8.4$          | 84         | SIP           |
| TPH1215S    | 12                    | $\pm 15$       | $\pm 68/\pm 6.8$          | 86         | SIP           |
| TPH1224S    | 12                    | $\pm 24$       | $\pm 42/\pm 4.2$          | 85         | SIP           |
| TPH1505D    | 15                    | $\pm 5$        | $\pm 200/\pm 20$          | 80         | DIP           |
| TPH1505S    | 15                    | $\pm 5$        | $\pm 200/\pm 20$          | 80         | SIP           |
| TPH1515S    | 15                    | $\pm 15$       | $\pm 68/\pm 6.8$          | 86         | SIP           |
| TPH2405D    | 24                    | $\pm 5$        | $\pm 200/\pm 20$          | 80         | DIP           |
| TPH2409D    | 24                    | $\pm 9$        | $\pm 110/\pm 11$          | 85         | DIP           |
| TPH2412D    | 24                    | $\pm 12$       | $\pm 84/\pm 8.4$          | 86         | DIP           |
| TPH2415D    | 24                    | $\pm 15$       | $\pm 68/\pm 6.8$          | 86         | DIP           |
| TPH2424D    | 24                    | $\pm 24$       | $\pm 42/\pm 4.2$          | 85         | DIP           |
| TPH2405S    | 24                    | $\pm 5$        | $\pm 200/\pm 20$          | 82         | SIP           |
| TPH2409S    | 24                    | $\pm 9$        | $\pm 110/\pm 11$          | 85         | SIP           |
| TPH2412S    | 24                    | $\pm 12$       | $\pm 84/\pm 8.4$          | 85         | SIP           |
| TPH2415S    | 24                    | $\pm 15$       | $\pm 68/\pm 6.8$          | 85         | SIP           |
| TPH2424S    | 24                    | $\pm 24$       | $\pm 42/\pm 4.2$          | 85         | SIP           |
| TPH4805D    | 48                    | $\pm 5$        | $\pm 200/\pm 20$          | 82         | DIP           |
| TPH4809D    | 48                    | $\pm 9$        | $\pm 110/\pm 11$          | 82         | DIP           |
| TPH4812D    | 48                    | $\pm 12$       | $\pm 84/\pm 8.4$          | 85         | DIP           |
| TPH4815D    | 48                    | $\pm 15$       | $\pm 68/\pm 6.8$          | 85         | DIP           |
| TPH4805S    | 48                    | $\pm 5$        | $\pm 200/\pm 20$          | 82         | SIP           |
| TPH4809S    | 48                    | $\pm 9$        | $\pm 110/\pm 11$          | 83         | SIP           |
| TPH4812S    | 48                    | $\pm 12$       | $\pm 84/\pm 8.4$          | 85         | SIP           |
| TPH4815S    | 48                    | $\pm 15$       | $\pm 68/\pm 6.8$          | 84         | SIP           |

## SELECTION GUIDE

| Part Number | Nominal Input Voltage | Output Voltage | Output Current(Max./Min) | Efficiency | Package Style |
|-------------|-----------------------|----------------|--------------------------|------------|---------------|
|             | V                     | V              | mA                       | %          |               |
| TPH0303DA   | 3.3                   | 3.3            | 606/60.6                 | 73         | DIP           |
| TPH0305DA   | 3.3                   | 5              | 400/40                   | 79         | DIP           |
| TPH0503DA   | 5                     | 3.3            | 606/60.6                 | 74         | DIP           |
| TPH0505DA   | 5                     | 5              | 400/40                   | 80         | DIP           |
| TPH0509DA   | 5                     | 9              | 220/22                   | 80         | DIP           |
| TPH0512DA   | 5                     | 12             | 168/16.8                 | 81         | DIP           |
| TPH0515DA   | 5                     | 15             | 136/13.6                 | 84         | DIP           |
| TPH1205DA   | 12                    | 5              | 400/40                   | 80         | DIP           |
| TPH1209DA   | 12                    | 9              | 220/22                   | 83         | DIP           |
| TPH1212DA   | 12                    | 12             | 168/16.8                 | 84         | DIP           |
| TPH1215DA   | 12                    | 15             | 136/13.6                 | 86         | DIP           |
| TPH1224DA   | 12                    | 24             | 83/8.3                   | 87         | DIP           |
| TPH2405DA   | 24                    | 5              | 400/40                   | 80         | DIP           |
| TPH2409DA   | 24                    | 9              | 220/22                   | 85         | DIP           |
| TPH2412DA   | 24                    | 12             | 168/16.8                 | 86         | DIP           |
| TPH2415DA   | 24                    | 15             | 136/13.6                 | 86         | DIP           |
| TPH2424DA   | 24                    | 24             | 84/8.4                   | 85         | DIP           |
| TPH4805DA   | 48                    | 5              | 400/40                   | 82         | DIP           |
| TPH4809DA   | 48                    | 9              | 220/22                   | 82         | DIP           |
| TPH4812DA   | 48                    | 12             | 168/16.8                 | 85         | DIP           |
| TPH4815DA   | 48                    | 15             | 136/13.6                 | 85         | DIP           |

Add suffix "P" for continuous short circuit protection, for example TPH0505SP.

## GENERAL CHARACTERISTICS

| Parameter           | Conditions      | Min. | Typ. | Max. | Units |
|---------------------|-----------------|------|------|------|-------|
| Switching frequency | 3.3V & 5V input |      | 90   |      | kHz   |
| Switching frequency | 12V input       |      | 90   |      | kHz   |
| Switching frequency | 15V input       |      | 90   |      | kHz   |
| Switching frequency | 24V & 48V input |      | 90   |      | kHz   |

## INPUT CHARACTERISTICS

| Parameter     | Conditions | Min. | Typ. | Max. | Units |
|---------------|------------|------|------|------|-------|
| Voltage range | 3.3V input | 2.9  | 3.3  | 3.6  | V     |
| Voltage range | 5V input   | 4.5  | 5    | 5.5  | V     |
| Voltage range | 12V input  | 11   | 12   | 13   | V     |
| Voltage range | 24V input  | 22   | 24   | 26   | V     |
| Voltage range | 48V input  | 43   | 48   | 53   | V     |

## OUTPUT CHARACTERISTICS

| Parameter                               | Conditions                                    | Min. | Max. | Units |
|-----------------------------------------|-----------------------------------------------|------|------|-------|
| Rated Power                             | TA=-40°C to 85°C                              |      | 2    | W     |
| Voltage Set Point Accuracy              | TPH0505D/S                                    | -5   | 7.5  | %     |
| Voltage Set Point Accuracy              | All other types                               | -5   | 5    | %     |
| Line regulation                         | High VIN to low VIN (voltage variation +/-5%) |      | 1.2  | %     |
| Load Regulation(10% load to rated load) | 5V output                                     |      | 10   | %     |
| Load Regulation(10% load to rated load) | 9V output                                     |      | 10   | %     |
| Load Regulation(10% load to rated load) | 12V output                                    |      | 10   | %     |
| Load Regulation(10% load to rated load) | 15V output                                    |      | 10   | %     |

## ISOLATION CHARACTERISTICS

| Parameter              | Conditions                | Min. | Typ. | Max. | Units |
|------------------------|---------------------------|------|------|------|-------|
| Isolation test voltage | Flash tested for 1 second | 3000 |      |      | VDC   |
| Resistance             | Viso= 1000V               | 1    |      |      | GΩ    |

## ABSOLUTE MAXIMUM RATINGS

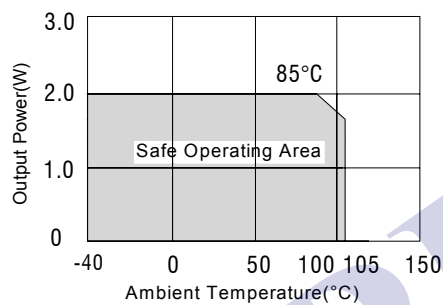
|                                                 |          |
|-------------------------------------------------|----------|
| Short-circuit protection                        | 1 second |
| Lead temperature 1.5mm from case for 10 seconds | 300℃     |
| Internal power dissipation                      | 300mW    |
| Input voltage Vin, TPH03                        | 5.5V     |
| Input voltage Vin, TPH05                        | 7V       |
| Input voltage Vin, TPH12                        | 15V      |
| Input voltage Vin, TPH15                        | 18V      |
| Input voltage Vin, TPH24                        | 28V      |
| Input voltage Vin, TPH48                        | 54V      |

## TEMPERATURE CHARACTERISTICS

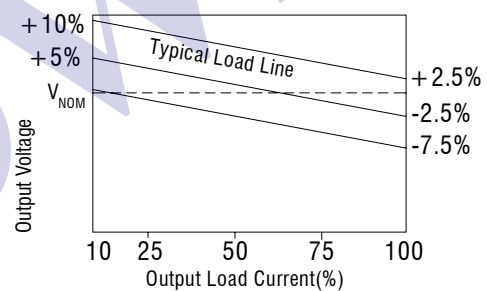
| Parameter              | Conditions                                            | Min. | Typ. | Max. | Units |
|------------------------|-------------------------------------------------------|------|------|------|-------|
| Specification          | Derating if the temperature $\geq 85^{\circ}\text{C}$ | -40  |      | 105  | ℃     |
| Storage                |                                                       | -50  |      | 130  | ℃     |
| Case Temperature above | 5V output                                             |      | 33   |      | ℃     |
| Case Temperature above | 12V output                                            |      | 27   |      | ℃     |
| Cooling                | Free air convection                                   |      |      |      |       |

All specifications typical at  $T_A=25^{\circ}\text{C}$ , nominal input voltage and rated output current unless otherwise

## TEMPERATURE DERATING GRAPHS

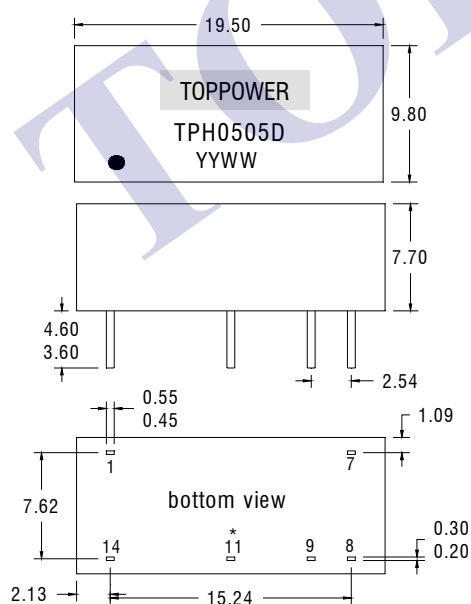


## TOLERANCE ENVELOPES

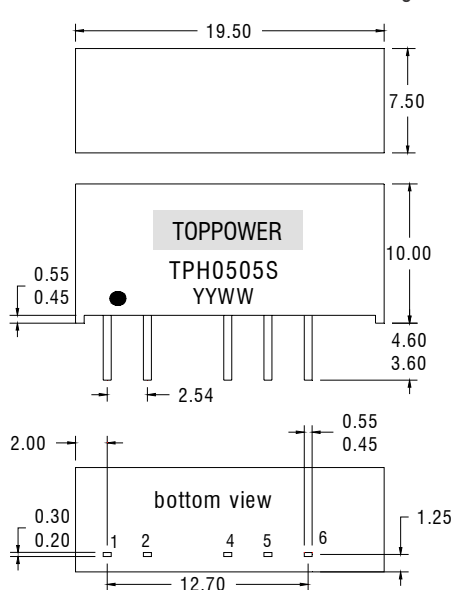


## MECHANICAL DIMENSIONS

### DIP Package



### SIP Package



## PIN CONNECTIONS

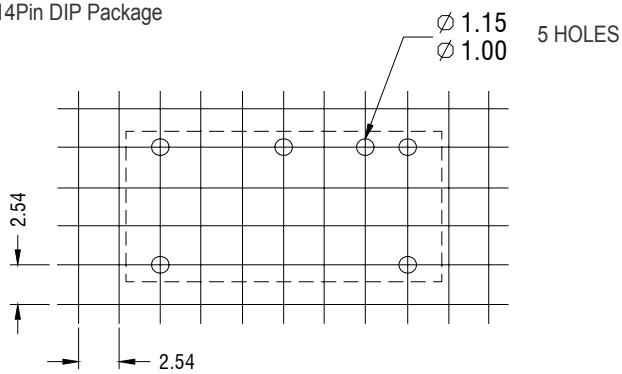
| 14 PIN DIP |          |
|------------|----------|
| Pin        | Function |
| 1          | -Vin     |
| 7          | NC       |
| 8          | OV       |
| 9          | +Vout    |
| 11         | -Vout    |
| 14         | +Vin     |

| 7 PIN SIP |          |
|-----------|----------|
| Pin       | Function |
| 1         | +Vin     |
| 2         | -Vin     |
| 4         | -Vout    |
| 5         | OV       |
| 6         | +Vout    |

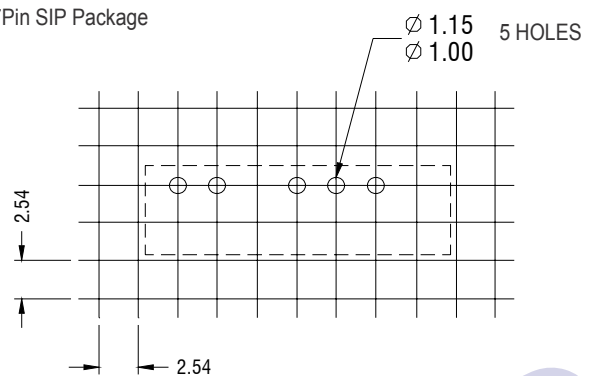
All dimensions in mm  $\pm 0.25\text{mm}$ . All pins on a 2.54 mm pitch and within  $\pm 0.25\text{mm}$  of true position.  
Weight: 2.85g (DIP) 2.76g (SIP) \* Pin not fitted on single output variants.

**RECOMMENDED FOOTPRINT DETAILS**

14Pin DIP Package

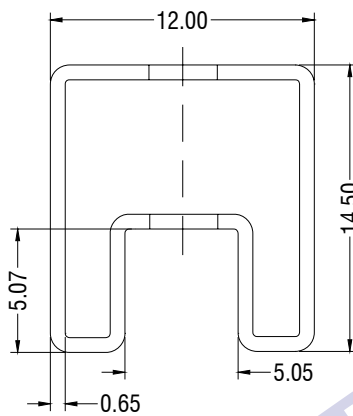


7Pin SIP Package

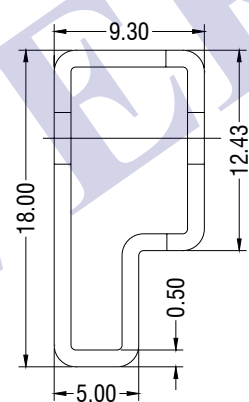


**TUBE OUTLINE DIMENSIONS**

14Pin DIP Tube



7Pin SIPTube



Unless otherwise stated all dimensions in mm  $\pm 0.5$ mm.

Tube length (14 Pin DIP) : 520mm  $\pm 2$ mm.

Tube length (7 Pin SIP) : 520mm  $\pm 2$ mm.

Tube Quantity:25PCS

**SOLDERING INFORMATION**

This series is compatible with RoHS soldering systems with a peak wave solder temperature of 300°C for 10 seconds. Both SIP and DIP types in this series are backward compatible with Sn/Pb soldering systems.