

- 2" x 1" x 0.4" shielded metal package
- Ultra wide 4:1 input voltage range
- Single- dual- and triple output models
- Very high efficiency up to 91 %
- Operating temperature range -40 °C to +75 °C
- Over temperature protection
- I/O isolation 1600 VDC
- Remote On/Off
- Adjustable output voltage
- 3-year product warranty



The TEN 30WIN series is a family of high performance 30W DC/DC converter modules featuring ultra wide 4:1 input voltage ranges in a compact low profile case with industry-standard footprint. Standard features include remote On/Off, output voltage trimming, over voltage protection, under voltage lockout, over temperature and short circuit protection. Typical applications for these products are battery operated equipment and distributed power architectures in communication and industrial electronics, everywhere where isolated, tightly regulated voltages are required and space is limited on the PCB.

### Models

| Order Code     | Input Voltage Range         | Output 1                     |                  | Output 2 |                  | Output 3 |                  | Efficiency typ. |
|----------------|-----------------------------|------------------------------|------------------|----------|------------------|----------|------------------|-----------------|
|                |                             | Vnom                         | I <sub>max</sub> | Vnom     | I <sub>max</sub> | Vnom     | I <sub>max</sub> |                 |
| TEN 30-2410WIN | 9 - 36 VDC<br>(24 VDC nom.) | 3.3 VDC                      | 7'500 mA         |          |                  |          |                  | 86 %            |
| TEN 30-2411WIN |                             | 5.1 VDC                      | 6'000 mA         |          |                  |          |                  | 88 %            |
| TEN 30-2412WIN |                             | 12 VDC                       | 2'500 mA         |          |                  |          |                  | 89 %            |
| TEN 30-2413WIN |                             | 15 VDC                       | 2'000 mA         |          |                  |          |                  | 89 %            |
| TEN 30-2421WIN |                             | +5 VDC                       | 3'000 mA         | -5 VDC   | 3'000 mA         |          |                  | 88 %            |
| TEN 30-2422WIN |                             | +12 VDC                      | 1'250 mA         | -12 VDC  | 1'250 mA         |          |                  | 87 %            |
| TEN 30-2423WIN |                             | +15 VDC                      | 1'000 mA         | -15 VDC  | 1'000 mA         |          |                  | 87 %            |
| TEN 30-2431WIN |                             | +5 VDC                       | 4'000 mA         | +12 VDC  | 416 mA           | -12 VDC  | 416 mA           | 88 %            |
| TEN 30-2432WIN |                             | +5 VDC                       | 4'000 mA         | +15 VDC  | 333 mA           | -15 VDC  | 333 mA           | 88 %            |
| TEN 30-2433WIN |                             | +3.3 VDC                     | 5'000 mA         | +12 VDC  | 416 mA           | -12 VDC  | 416 mA           | 87 %            |
| TEN 30-2434WIN |                             | +3.3 VDC                     | 5'000 mA         | +15 VDC  | 333 mA           | -15 VDC  | 333 mA           | 87 %            |
| TEN 30-4810WIN |                             | 18 - 75 VDC<br>(48 VDC nom.) | 3.3 VDC          | 7'500 mA |                  |          |                  |                 |
| TEN 30-4811WIN | 5.1 VDC                     |                              | 6'000 mA         |          |                  |          |                  | 88 %            |
| TEN 30-4812WIN | 12 VDC                      |                              | 2'500 mA         |          |                  |          |                  | 90 %            |
| TEN 30-4813WIN | 15 VDC                      |                              | 2'000 mA         |          |                  |          |                  | 91 %            |
| TEN 30-4821WIN | +5 VDC                      |                              | 3'000 mA         | -5 VDC   | 3'000 mA         |          |                  | 88 %            |
| TEN 30-4822WIN | +12 VDC                     |                              | 1'250 mA         | -12 VDC  | 1'250 mA         |          |                  | 88 %            |
| TEN 30-4823WIN | +15 VDC                     |                              | 1'000 mA         | -15 VDC  | 1'000 mA         |          |                  | 88 %            |
| TEN 30-4831WIN | +5 VDC                      |                              | 4'000 mA         | +12 VDC  | 416 mA           | -12 VDC  | 416 mA           | 88 %            |
| TEN 30-4832WIN | +5 VDC                      |                              | 4'000 mA         | +15 VDC  | 333 mA           | -15 VDC  | 333 mA           | 88 %            |
| TEN 30-4833WIN | +3.3 VDC                    |                              | 5'000 mA         | +12 VDC  | 416 mA           | -12 VDC  | 416 mA           | 87 %            |
| TEN 30-4834WIN | +3.3 VDC                    |                              | 5'000 mA         | +15 VDC  | 333 mA           | -15 VDC  | 333 mA           | 87 %            |

### Options

|   |  |
|---|--|
| TEN-HS1   | - Optional Heat Sink with Height = 0.22 inch: <a href="http://www.tracopower.com/products/ten-hs1.pdf">www.tracopower.com/products/ten-hs1.pdf</a>   |
| on demand<br>(backorder with MOQ non stocking item) | - Optional model with 1.5 VDC / 8'500 mA Output and 9 - 36 VDC Input<br>- Optional model with 2.5 VDC / 8'000 mA Output and 9 - 36 VDC Input<br>- Optional model with 1.5 VDC / 8'500 mA Output and 18 - 75 VDC Input<br>- Optional model with 2.5 VDC / 8'000 mA Output and 18 - 75 VDC Input |

## Input Specifications

|                          |                |   |
|--------------------------|----------------|---|
| Input Current            | - At no load   | 24 Vin models: <b>70 mA typ.</b> (1.5 Vout model)<br><b>70 mA typ.</b> (2.5 Vout model)<br><b>85 mA typ.</b> (3.3 Vout model)<br><b>115 mA typ.</b> (5.1 Vout model)<br><b>20 mA typ.</b> (12 Vout model)<br><b>30 mA typ.</b> (15 Vout model)<br><b>90 mA typ.</b> (5 / -5 Vout model)<br><b>25 mA typ.</b> (12 / -12 Vout model)<br><b>25 mA typ.</b> (15 / -15 Vout model)<br><b>105 mA typ.</b> (5 / 12 / -12 Vout model)<br><b>105 mA typ.</b> (5 / 15 / -15 Vout model)<br><b>105 mA typ.</b> (3.3 / 12 / -12 Vout model)<br><b>105 mA typ.</b> (3.3 / 15 / -15 Vout model) |
|                          | - At full load | 48 Vin models: <b>30 mA typ.</b> (1.5 Vout model)<br><b>45 mA typ.</b> (2.5 Vout model)<br><b>45 mA typ.</b> (3.3 Vout model)<br><b>65 mA typ.</b> (5.1 Vout model)<br><b>65 mA typ.</b> (12 Vout model)<br><b>50 mA typ.</b> (15 Vout model)<br><b>50 mA typ.</b> (5 / -5 Vout model)<br><b>15 mA typ.</b> (12 / -12 Vout model)<br><b>15 mA typ.</b> (15 / -15 Vout model)<br><b>55 mA typ.</b> (5 / 12 / -12 Vout model)<br><b>55 mA typ.</b> (5 / 15 / -15 Vout model)<br><b>55 mA typ.</b> (3.3 / 12 / -12 Vout model)<br><b>55 mA typ.</b> (3.3 / 15 / -15 Vout model)      |
| Surge Voltage            |                | 24 Vin models: <b>50 VDC max.</b> (100 ms max.)<br>48 Vin models: <b>100 VDC max.</b> (100 ms max.)   |
| Under Voltage Lockout    |                | 24 Vin models: <b>7 VDC min. / 8 VDC typ. / 8.8 VDC max.</b><br>48 Vin models: <b>15 VDC min. / 16 VDC typ. / 17.5 VDC max.</b>   |
| Reflected Ripple Current |                | <b>20 mA typ.</b>   |
| Recommended Input Fuse   |                | 24 Vin models: <b>6'300 mA</b> (slow blow)<br>48 Vin models: <b>3'150 mA</b> (slow blow)<br>(The need of an external fuse has to be assessed in the final application.)   |
| Input Filter             |                | <b>Internal Pi-Type</b>   |

## Output Specifications

|                           |  |   |
|---------------------------|--|---|
| Output Voltage Adjustment |  | <b>±10%</b> (single output models only)<br>(By external trim resistor)<br>See application note: <a href="http://www.tracopower.com/overview/ten30win">www.tracopower.com/overview/ten30win</a><br>Output power must not exceed rated power! |
| Voltage Set Accuracy      |  | <b>±1% max.</b> (±5 % for auxiliary outputs)  |

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

|   |   |   |
|---|---|---|
| <b>Regulation</b>   | - Input Variation (Vmin - Vmax)   | single output models: <b>0.2% max.</b>  |
|   |   | dual output models: <b>0.25% max.</b> ( $\pm 5$ Vout models)<br><b>0.2% max.</b> (other dual models)  |
|   | - Load Variation (0 - 100%)   | triple output models: <b>1% max.</b><br><b>5% max.</b> (aux)  |
|   |   | single output models: <b>0.5% max.</b><br>dual output models: <b>1% max.</b> (Output 1)<br><b>1% max.</b> (Output 2)<br>triple output models: <b>1% max.</b> (Output 1)<br><b>5% max.</b> (Output 2)<br><b>5% max.</b> (Output 3) |
| - Cross Regulation<br>(25% / 100% asym. load)   | dual output models: <b>5% max.</b>  |   |
| <b>Ripple and Noise</b><br>(20 MHz Bandwidth)   | - single output   | 1.5 Vout: <b>100 mVp-p typ.</b> (w/ 1 $\mu$ F, 50 V MLCC)   |
|   |   | 2.5 Vout: <b>100 mVp-p typ.</b> (w/ 1 $\mu$ F, 50 V MLCC)   |
|   |   | 3.3 Vout: <b>100 mVp-p typ.</b> (w/ 1 $\mu$ F, 50 V MLCC)   |
|   |   | 5.1 Vout: <b>100 mVp-p typ.</b> (w/ 1 $\mu$ F, 50 V MLCC)   |
|   |   | 12 Vout: <b>150 mVp-p typ.</b> (w/ 1 $\mu$ F, 50 V MLCC)  |
|   | - dual output   | 15 Vout: <b>150 mVp-p typ.</b> (w/ 1 $\mu$ F, 50 V MLCC)  |
|   |   | 5 / -5 Vout: <b>100 / 100 mVp-p typ.</b> (w/ 1 $\mu$ F, 50 V MLCC)  |
|   |   | 12 / -12 Vout: <b>150 / 150 mVp-p typ.</b> (w/ 1 $\mu$ F, 50 V MLCC)  |
|   | - triple output   | 15 / -15 Vout: <b>150 / 150 mVp-p typ.</b> (w/ 1 $\mu$ F, 50 V MLCC)  |
|   |   | 5 / 12 / -12 Vout: <b>50 / 75 / 75 mVp-p typ.</b> (w/ 0.1 $\mu$ F, 50 V MLCC)   |
| 5 / 15 / -15 Vout: <b>50 / 75 / 75 mVp-p typ.</b> (w/ 0.1 $\mu$ F, 50 V MLCC)                   |   |   |
| 3.3 / 12 / -12 Vout: <b>50 / 75 / 75 mVp-p typ.</b> (w/ 0.1 $\mu$ F, 50 V MLCC)                 |   |   |
| 3.3 / 15 / -15 Vout: <b>50 / 75 / 75 mVp-p typ.</b> (w/ 0.1 $\mu$ F, 50 V MLCC)                 |   |   |
| <b>Capacitive Load</b>  | - single output   | 1.5 Vout: <b>20'000 <math>\mu</math>F max.</b>  |
|   |   | 2.5 Vout: <b>20'000 <math>\mu</math>F max.</b>  |
|   |   | 3.3 Vout: <b>20'000 <math>\mu</math>F max.</b>  |
|   |   | 5.1 Vout: <b>14'400 <math>\mu</math>F max.</b>  |
|   |   | 12 Vout: <b>3'000 <math>\mu</math>F max.</b>  |
|   | - dual output   | 15 Vout: <b>2'000 <math>\mu</math>F max.</b>  |
|   |   | 5 / -5 Vout: <b>3'000 / 3'000 <math>\mu</math>F max.</b>  |
|   |   | 12 / -12 Vout: <b>2'000 / 2'000 <math>\mu</math>F max.</b>  |
|   | - triple output   | 15 / -15 Vout: <b>1'300 / 1'300 <math>\mu</math>F max.</b>  |
|   |   | 5 / 12 / -12 Vout: <b>8'000 / 340 / 340 <math>\mu</math>F max.</b>  |
| 5 / 15 / -15 Vout: <b>8'000 / 220 / 220 <math>\mu</math>F max.</b>                              |   |   |
| 3.3 / 12 / -12 Vout: <b>15'000 / 340 / 340 <math>\mu</math>F max.</b>                           |   |   |
| 3.3 / 15 / -15 Vout: <b>15'000 / 220 / 220 <math>\mu</math>F max.</b>                           |   |   |
| <b>Minimum Load</b>   | - single output   | 1.5 Vout: <b>0 % of Iout max.</b>   |
|   |   | 2.5 Vout: <b>0 % of Iout max.</b>   |
|   |   | 3.3 Vout: <b>0 % of Iout max.</b>   |
|   |   | 5.1 Vout: <b>0 % of Iout max.</b>   |
|   |   | 12 Vout: <b>0 % of Iout max.</b>  |
|   | - dual output   | 15 Vout: <b>0 % of Iout max.</b>  |
|   |   | 5 / -5 Vout: <b>0 % of Iout max.</b>  |
|   |   | 12 / -12 Vout: <b>0 % of Iout max.</b>  |
|   | - triple output   | 15 / -15 Vout: <b>0 % of Iout max.</b>  |
|   |   | 5 / 12 / -12 Vout: <b>10 % of Iout max.</b>   |
| 5 / 15 / -15 Vout: <b>10 % of Iout max.</b>   |   |   |
| 3.3 / 12 / -12 Vout: <b>10 % of Iout max.</b>   |   |   |
| 3.3 / 15 / -15 Vout: <b>10 % of Iout max.</b>   |   |   |
| (Operation at lower load will not damage the converter, but it may not meet all specifications) |   |   |
| <b>Temperature Coefficient</b>  | <b><math>\pm 0.02</math> %/K max.</b>   |   |
| <b>Start-up Time</b>  | <b>50 ms max.</b> (single & dual models)<br><b>30 ms max.</b> (triple models) |   |
| <b>Short Circuit Protection</b>   | <b>Continuous, Automatic recovery</b>   |   |

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

|                           |                  |  |
|---------------------------|------------------|--|
| Output Current Limitation |                  | 150% typ. of I <sub>out</sub> max.   |
| Overvoltage Protection    |                  | 125% typ. of V <sub>out</sub> nom.<br>(depending on model)<br>2 VDC (1.5 V <sub>out</sub> model)<br>3.3 VDC (2.5 V <sub>out</sub> model)<br>3.9 VDC (3.3 V <sub>out</sub> model)<br>6.2 VDC (5 / 5.1 V <sub>out</sub> model)<br>15 VDC (12 V <sub>out</sub> model)<br>18 VDC (15 V <sub>out</sub> model) |
| Transient Response        | - Peak Variation | 370 mV max. (25% Load Step)  |
|                           | - Response Time  | 250 μs typ. (25% Load Step)  |

### Safety Specifications

|                       |                             |  |
|-----------------------|-----------------------------|--|
| Standards             | - IT / Multimedia Equipment | EN 60950-1<br>EN 62368-1<br>IEC 60950-1<br>IEC 62368-1<br>UL 60950-1<br>UL 62368-1             |
|                       | - Certification Documents   | <a href="http://www.tracopower.com/overview/ten30win">www.tracopower.com/overview/ten30win</a> |
| Pollution Degree      |                             | PD 2   |
| Over Voltage Category |                             | OVC I  |

### EMC Specifications

|               |                             |  |
|---------------|-----------------------------|--|
| EMI Emissions | - Conducted Emissions       | EN 55032 class A (with external filter)<br>EN 55032 class B (with external filter)                   |
|               | - Radiated Emissions        | EN 55032 class A (with external filter)<br>EN 55032 class B (with external filter)                   |
|               | External filter proposal:   | <a href="http://www.tracopower.com/overview/ten30win">www.tracopower.com/overview/ten30win</a>       |
| EMS Immunity  | - Electrostatic Discharge   | Air: EN 61000-4-2, ±8 kV, perf. criteria A<br>Contact: EN 61000-4-2, ±6 kV, perf. criteria A         |
|               | - RF Electromagnetic Field  | EN 61000-4-3, 10 V/m, perf. criteria A   |
|               | - EFT (Burst) / Surge       | EN 61000-4-4, ±2 kV, perf. criteria A<br>EN 61000-4-5, ±1 kV, perf. criteria A                       |
|               |                             | Ext. input component: 24 Vin models: KY 330 μF / 50 V<br>48 Vin models: KY 220 μF / 100 V            |
|               | - Conducted RF Disturbances | EN 61000-4-6, 10 V <sub>rms</sub> , perf. criteria A   |
|               | - PF Magnetic Field         | Continuous: EN 61000-4-8, 100 A/m, perf. criteria A<br>1 s: EN 61000-4-8, 1000 A/m, perf. criteria A |

### General Specifications

|  |  |  |
|--|--|--|
| Relative Humidity                      |  | 95% max. (non condensing)  |
| Temperature Ranges                     | - Operating Temperature                    | -40°C to +75°C   |
|  | - Case Temperature                         | +105°C max.  |
|  | - Storage Temperature                      | -55°C to +125°C  |
| Power Derating                         | - High Temperature                         | Depending on model<br>See application note: <a href="http://www.tracopower.com/overview/ten30win">www.tracopower.com/overview/ten30win</a> |
| Over Temperature Protection Switch Off | - Protection Mode<br>- Measurement Point   | 115°C max. (Automatic recovery at 105°C typ.)<br>Case  |
| Cooling System                         |  | Natural convection (20 LFM)  |
| Remote Control                         | - Voltage Controlled Remote (passive = on) | On: 3.0 to 12 VDC or open circuit<br>Off: 0 to 1.2 VDC or short circuit<br>Refers to 'Remote' and '-Vin' Pin                               |
|  | - Off Idle Input Current                   | 3 mA typ.  |
|  | - Remote Pin Input Current                 | -0.5 to 0.5 mA   |
| Altitude During Operation              |  | 5'000 m max.   |

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

|                          |  |  |
|--------------------------|--|--|
| Switching Frequency      |  | 387 - 473 kHz (PWM) (single, dual output models)<br>360 - 440 kHz (PWM) (triple output models)   |
| Insulation System        |  | Functional Insulation  |
| Isolation Test Voltage   | - Input to Output, 60 s<br>- Input to Case, 60 s<br>- Output to Case, 60 s   | 1'600 VDC<br>1'600 VDC<br>1'600 VDC  |
| Isolation Resistance     | - Input to Output, 500 VDC   | 1'000 MΩ min.  |
| Isolation Capacitance    | - Input to Output, 100 kHz, 1 V  | 1'500 pF max.  |
| Reliability              | - Calculated MTBF  | 1'300'000 h (single and dual output models)<br>1'200'000 h (triple output models)<br>(MIL-HDBK-217F, ground benign)  |
| Washing Process          |  | According to Cleaning Guideline<br><a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>  |
| Environment              | - Vibration<br><br>- Mechanical Shock<br><br>- Thermal Shock                 | MIL-STD-810F<br>7.6 g, 3 axis, 60 min, 20-2000 Hz<br>MIL-STD-810F<br>40 g, 3 axis, terminal peak sawtooth, 11 ms<br>MIL-STD-810F<br>-55°C to +125°C, 72 cycles, 30 min each  |
| Housing Material         |  | Copper, Nickel plated  |
| Base Material            |  | Non-conductive FR4 (UL 94 V-0 rated)   |
| Potting Material         |  | Epoxy (UL 94 V-0 rated)  |
| Pin Material             |  | Copper   |
| Pin Foundation Plating   |  | Nickel (2 - 3 μm)  |
| Pin Surface Plating      |  | Tin (3 - 5 μm), matte  |
| Housing Type             |  | Metal Case   |
| Mounting Type            |  | PCB Mount  |
| Connection Type          |  | THD (Through-Hole Device)  |
| Footprint Type           |  | 2" x 1"  |
| Soldering Profile        |  | Lead-Free Wave Soldering<br>260°C / 6 s max.   |
| Weight                   |  | 30.5 g   |
| Thermal Impedance        | - Case to Ambient  | 12 K/W typ.<br>10 K/W typ. (with Heat Sink)  |
| Environmental Compliance | - REACH Declaration<br><br>- RoHS Declaration<br><br>- SCIP Reference Number | <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a><br>REACH SVHC list compliant<br>REACH Annex XVII compliant<br><a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a><br>Exemptions: 7a, 7c-I<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))<br>6d4d2567-f4c4-424d-82c4-6afb32e4abf1 |

## Supporting Documents

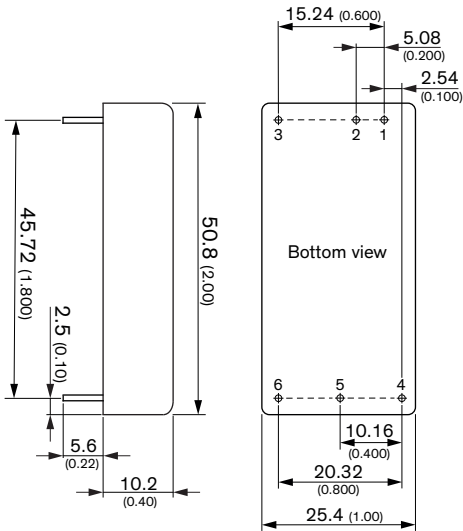
Overview Link (for additional Documents)

[www.tracopower.com/overview/ten30win](http://www.tracopower.com/overview/ten30win)

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

### Outline Dimensions

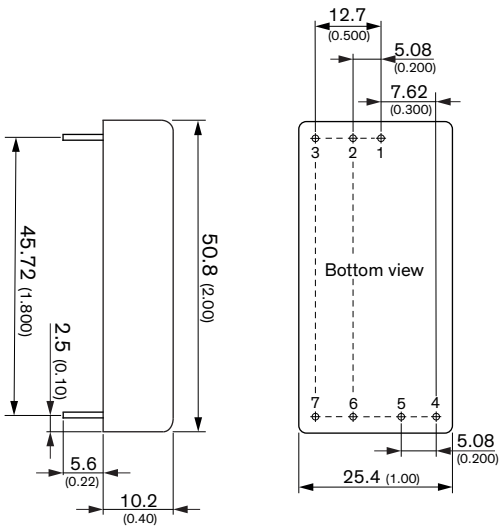
#### Single and dual output models



Dimensions in mm (inch)  
 Pin diameter:  $1.0 \pm 0.1$  ( $0.04 \pm 0.004$ )  
 Tolerances:  $x.x \pm 0.5$  ( $x.xx \pm 0.02$ )  
 $x.xx \pm 0.25$  ( $x.xxx \pm 0.01$ )

| Pinout |               |        |
|--------|---------------|--------|
| Pin    | Single        | Dual   |
| 1      | +Vin (Vcc)    |        |
| 2      | -Vin (GND)    |        |
| 3      | Remote On/Off |        |
| 4      | +Vout         |        |
| 5      | -Vout         | Common |
| 6      | Trim          | -Vout  |

#### Triple output models



Dimensions in mm (inch)  
 Pin diameter:  $1.0 \pm 0.1$  ( $0.04 \pm 0.004$ )  
 Tolerances:  $x.x \pm 0.5$  ( $x.xx \pm 0.02$ )  
 $x.xx \pm 0.25$  ( $x.xxx \pm 0.01$ )

| Pinout |               |
|--------|---------------|
| Pin    | Triple        |
| 1      | +Vin (Vcc)    |
| 2      | -Vin (GND)    |
| 3      | Remote On/Off |
| 4      | Output 2      |
| 5      | Output 3      |
| 6      | Common        |
| 7      | Output 1      |