## Features

- High power density: 40 W in a 51x51x10mm (2”x2”x0.4”) package
- Wide 2:1 input voltage range
- Models with single-, dual- and triple output
- Models with 2 independently regulated 3.3 and 5.0 VDC outputs
- Extended operating temperature range: –40°C to +75°C
- Over temperature protection
- Under voltage lockout
- Remote On/Off
- Shielded metal case with insulated baseplate
- Optional heatsink
- Lead free design - RoHS compliant
- 3-years product warranty

## DC/DC Converters

**TEN 40 Series, 40 Watt**

### The TEN 40 series is a family of high performance 40W dc-dc converter modules featuring 30 standard models with wide 2:1 input voltage ranges in a compact low profile case with industry-standard footprint. A very high efficiency allows an operating temperature range of –40°C to +75°C. Built-in filters for both input and output minimizes the need for external filtering. Further standard features include remote On/Off, output voltage trimming, over voltage protection, under voltage lockout 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

<table>
<thead>
<tr>
<th>Order code</th>
<th>Input voltage range</th>
<th>Output 1</th>
<th>Output 2</th>
<th>Output 3</th>
<th>Efficiency typ..</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEN 40-1210</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>3.3 VDC / 8.0 A</td>
<td>5 VDC / 8.0 A</td>
<td>+12 VDC / 1.4 A</td>
<td>86 %</td>
</tr>
<tr>
<td>TEN 40-1211</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>12 VDC / 3.3 A</td>
<td>*5 VDC / 8.0 A</td>
<td>–12 VDC / 1.4 A</td>
<td>86 %</td>
</tr>
<tr>
<td>TEN 40-1212</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>*3.3 VDC / 8.0 A</td>
<td>*5 VDC / 8.0 A</td>
<td>–12 VDC / 1.4 A</td>
<td>85 %</td>
</tr>
<tr>
<td>TEN 40-1220</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>+12 VDC / 1.4 A</td>
<td>–12 VDC / 1.4 A</td>
<td>–12 VDC / 1.4 A</td>
<td>85 %</td>
</tr>
<tr>
<td>TEN 40-1222</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>+15 VDC / 1.4 A</td>
<td>–15 VDC / 1.4 A</td>
<td>–15 VDC / 1.4 A</td>
<td>85 %</td>
</tr>
<tr>
<td>TEN 40-1223</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>3.3 VDC / 6.0 A</td>
<td>+12 VDC / 0.4 A</td>
<td>–12 VDC / 0.4 A</td>
<td>85 %</td>
</tr>
<tr>
<td>TEN 40-1230</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>12 VDC / 6.0 A</td>
<td>+15 VDC / 0.3 A</td>
<td>–15 VDC / 0.3 A</td>
<td>85 %</td>
</tr>
<tr>
<td>TEN 40-1231</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>3.3 VDC / 6.0 A</td>
<td>+15 VDC / 0.3 A</td>
<td>–12 VDC / 0.4 A</td>
<td>86 %</td>
</tr>
<tr>
<td>TEN 40-1232</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>5 VDC / 6.0 A</td>
<td>+12 VDC / 0.4 A</td>
<td>–12 VDC / 0.4 A</td>
<td>86 %</td>
</tr>
<tr>
<td>TEN 40-1233</td>
<td>9 – 18 VDC (nominal 12 VDC)</td>
<td>5 VDC / 6.0 A</td>
<td>+15 VDC / 0.3 A</td>
<td>–15 VDC / 0.3 A</td>
<td>86 %</td>
</tr>
<tr>
<td>TEN 40-2410</td>
<td>18 – 36 VDC (nominal 24 VDC)</td>
<td>3.3 VDC / 8.0 A</td>
<td>5 VDC / 8.0 A</td>
<td>+12 VDC / 1.8 A</td>
<td>87 %</td>
</tr>
<tr>
<td>TEN 40-2411</td>
<td>18 – 36 VDC (nominal 24 VDC)</td>
<td>12 VDC / 3.3 A</td>
<td>*5 VDC / 8.0 A</td>
<td>–12 VDC / 1.8 A</td>
<td>89 %</td>
</tr>
<tr>
<td>TEN 40-2412</td>
<td>18 – 36 VDC (nominal 24 VDC)</td>
<td>*3.3 VDC / 8.0 A</td>
<td>*5 VDC / 8.0 A</td>
<td>–12 VDC / 1.8 A</td>
<td>86 %</td>
</tr>
<tr>
<td>TEN 40-2420</td>
<td>18 – 36 VDC (nominal 24 VDC)</td>
<td>+12 VDC / 1.8 A</td>
<td>–12 VDC / 1.8 A</td>
<td>–12 VDC / 1.8 A</td>
<td>87 %</td>
</tr>
<tr>
<td>TEN 40-2422</td>
<td>18 – 36 VDC (nominal 24 VDC)</td>
<td>+15 VDC / 1.4 A</td>
<td>–15 VDC / 1.4 A</td>
<td>–15 VDC / 1.4 A</td>
<td>87 %</td>
</tr>
<tr>
<td>TEN 40-2423</td>
<td>18 – 36 VDC (nominal 24 VDC)</td>
<td>3.3 VDC / 6.0 A</td>
<td>+12 VDC / 0.4 A</td>
<td>–12 VDC / 0.4 A</td>
<td>85 %</td>
</tr>
<tr>
<td>TEN 40-2430</td>
<td>18 – 36 VDC (nominal 24 VDC)</td>
<td>5 VDC / 6.0 A</td>
<td>+15 VDC / 0.3 A</td>
<td>–12 VDC / 0.4 A</td>
<td>87 %</td>
</tr>
<tr>
<td>TEN 40-2431</td>
<td>18 – 36 VDC (nominal 24 VDC)</td>
<td>5 VDC / 6.0 A</td>
<td>+12 VDC / 0.4 A</td>
<td>–12 VDC / 0.4 A</td>
<td>87 %</td>
</tr>
<tr>
<td>TEN 40-2432</td>
<td>18 – 36 VDC (nominal 24 VDC)</td>
<td>5 VDC / 6.0 A</td>
<td>+15 VDC / 0.3 A</td>
<td>–15 VDC / 0.3 A</td>
<td>87 %</td>
</tr>
<tr>
<td>TEN 40-4810</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>3.3 VDC / 8.0 A</td>
<td>5 VDC / 8.0 A</td>
<td>+12 VDC / 1.8 A</td>
<td>88 %</td>
</tr>
<tr>
<td>TEN 40-4811</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>12 VDC / 3.3 A</td>
<td>*5 VDC / 8.0 A</td>
<td>–12 VDC / 1.8 A</td>
<td>90 %</td>
</tr>
<tr>
<td>TEN 40-4812</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>*3.3 VDC / 8.0 A</td>
<td>*5 VDC / 8.0 A</td>
<td>–12 VDC / 1.8 A</td>
<td>89 %</td>
</tr>
<tr>
<td>TEN 40-4820</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>+12 VDC / 1.8 A</td>
<td>–12 VDC / 1.8 A</td>
<td>–12 VDC / 1.8 A</td>
<td>87 %</td>
</tr>
<tr>
<td>TEN 40-4822</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>+15 VDC / 1.4 A</td>
<td>–15 VDC / 1.4 A</td>
<td>–15 VDC / 1.4 A</td>
<td>87 %</td>
</tr>
<tr>
<td>TEN 40-4823</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>3.3 VDC / 6.0 A</td>
<td>+12 VDC / 0.4 A</td>
<td>–12 VDC / 0.4 A</td>
<td>86 %</td>
</tr>
<tr>
<td>TEN 40-4830</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>3.3 VDC / 6.0 A</td>
<td>+15 VDC / 0.3 A</td>
<td>–15 VDC / 0.3 A</td>
<td>86 %</td>
</tr>
<tr>
<td>TEN 40-4831</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>3.3 VDC / 6.0 A</td>
<td>+15 VDC / 0.3 A</td>
<td>–15 VDC / 0.3 A</td>
<td>86 %</td>
</tr>
<tr>
<td>TEN 40-4832</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>5 VDC / 6.0 A</td>
<td>+12 VDC / 0.4 A</td>
<td>–12 VDC / 0.4 A</td>
<td>88 %</td>
</tr>
<tr>
<td>TEN 40-4833</td>
<td>36 – 75 VDC (nominal 48 VDC)</td>
<td>5 VDC / 6.0 A</td>
<td>+15 VDC / 0.3 A</td>
<td>–15 VDC / 0.3 A</td>
<td>88 %</td>
</tr>
</tbody>
</table>

Note: Multi output models have a common ground.

* dynamic current allocation, max. 8A total output current for both outputs together
**Input Specifications**

**Input current at no load**
- 12 V models: 200 mA typ.
- 24 V models: 100 mA typ.
- 48 V models: 50 mA typ.

**Input current at full load**
- (nominal input 12/24/48 Vin)
  - 3.3 V single output models: 2680 / 1325 / 655 mA typ.
  - 5.0 / 12 V single output models: 4065 / 2000 / 1000 mA typ.
  - 3.3 & 5 V dual output models: 3415 / 1685 / 825 mA typ.
  - ±12 / ±15 V dual output models: 4400 / 2100 / 1050 mA typ.
  - 3.3 V triple output models: 3000 / 1500 / 750 mA typ.
  - 5.0 V triple output models: 4000 / 1990 / 980 mA typ.

**Input voltage variation (dv/dt)** 5 V/ms max. [complies to ETS300 132 part 4.4]

**Start-up voltage / under voltage lockout**
- 12 Vin models: 9 VDC / 8 VDC (typ.)
- 24 Vin models: 17.8 VDC / 15.8 VDC (typ.)
- 48 Vin models: 36 VDC / 33 VDC (typ.)

**Surge voltage** 25/50/100 V max.

**Conducted noise** (input)
EN 55022 level A, FCC part 15, level A (with external components)

Please refer to Application note: [www.tracopower.com/overview/ten40](http://www.tracopower.com/overview/ten40)

**ESD** (input)
EN 61000-4-2, perf. criteria B

**Fast transient** (input)
EN 61000-4-4, perf. criteria B

**Surge** (input)
EN 61000-4-5, perf. criteria B

**Output Specifications**

**Voltage set accuracy** ±1 % (±0.5 % for auxiliary outputs)

**Output voltage adjustment** ±10 % (only for single output models and symmetric dual output models)

Please refer to Application note: [www.tracopower.com/overview/ten40](http://www.tracopower.com/overview/ten40)

**Regulation**
- Input variation Vin min. to Vin max.
  - single output models: 0.5 % max.
  - dual output models: 1 % max.
  - triple output models (main/auxiliary): 1 % max. / 5 % max.
- Load variation 10 – 100 %
  - single output models: 0.5 % max.
  - dual output models: 1 % max.
  - triple output models (main/auxiliary): 2 % max. / 5 % max.
- Load cross variation 25 % / 100 %
  - Dual output models: 5 % max.
  - Triple output models (main/auxiliary): 1 % max. / 5 % max.

**Temperature coefficient** ±0.02 %/K max.

**Ripple and noise** (20 MHz Bandwidth)
3.3 V & 5 V outputs: 50 mVpk-pk max.
Dual outputs: 150 mVpk-pk max.
All other outputs: 75 mVpk-pk max.

**Start up time (nominal Vin and constant resistive load)** 25 ms typ.

**Transient response time** (25% load change) 300 µs typ.

**Short circuit protection** indefinite (automatic recovery)

**Over load protection** 150 % of Iout max typ. foldback

**Thermal shutdown** at 115°C typ.

**Over voltage protection**
- 3.3 V output: 3.9 V
- 5 V output: 6.2 V
- 12 V output: 15 V
- 15 V output: 18 V

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

**Minimum load** (only for multiple output models) 10% of rated max current (on each output)  
(operation at lower load condition will not damage these converters, however, they may not meet all listed specifications)

<table>
<thead>
<tr>
<th>Capacitive load output models</th>
<th>3.3 V / 5 V / 12 V / 15 V:</th>
<th>21'000 / 13'600 / 2'360 / 1510 µF max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>dual output models (3.3 V / 5 V):</td>
<td>11'000 / 6'800 µF max.</td>
<td></td>
</tr>
<tr>
<td>dual output models (±12 V / ±15 V):</td>
<td>1'200 / 750 µF max. (on each output)</td>
<td></td>
</tr>
<tr>
<td>3.3 V triple output models:</td>
<td>13'000 / 330 µF max. (main/output 2 &amp; 3)</td>
<td></td>
</tr>
</tbody>
</table>

## General Specifications

### Temperature ranges
- **Operating**: –40°C to +75°C
- **Case temperature**: +100°C max.
- **Storage**: –55°C to +125°C

### Humidity (non condensing)
95 % rel H max.

### Derating
see application note: www.tracopower.com/overview/ten40

### Isolation voltage (60 sec.)
- Input / Output: 1'500 VDC

### Isolation resistance
- Input / Output: >1'000 M Ohm

### Isolation capacitance
- Input / Output: 1000 pF max.

### Remote On/Off
- **On**: 3.5 ... 12 VDC or open circuit.
- **Off**: 0 ... 1.2 VDC or short circuit pin 3 and pin 2
- **Off idle current**: 2.5 mA max.

### Switching frequency (fixed)
300 kHz typ. (Pulse width modulation PWM)

### Vibration
10–55 Hz, 10G, 30 minutes along X,Y,Z

### Safety standards
UL 60950, EN 60950, IEC 60950 compliance
UL 62368, EN 62368, IEC 62368 compliance up to 60 VDC input voltage (SELV limit)

### Safety approvals
- **Certification documents**
  www.tracopower.com/overview/ten40

## Physical Specifications

### Casing material
- copper, nickel plated

### Baseplate material
- none conductive FR4

### Potting material
- epoxy (UL 94V-0 -rated)

### Weight
- 65 g (2.3 oz)

### Soldering temperature
- max. 265°C / 10 sec.

### Environmental compliance
- **Reach**
- **RoHS**
  www.tracopower.com/info/reach-declaration.pdf
  RoHS directive 2011/65/EU

### Supporting documents:
www.tracopower.com/overview/ten40

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

Pin-Out

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
<th>Dual symmetric</th>
<th>Dual asymmetric</th>
<th>Triple</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>2</td>
<td>−Vin (GND)</td>
<td>−Vin (GND)</td>
<td>−Vin (GND)</td>
<td>−Vin (GND)</td>
</tr>
<tr>
<td>3</td>
<td>Remote On/Off</td>
<td>No pin</td>
<td>Vout 1</td>
<td>Vout 2</td>
</tr>
<tr>
<td>4</td>
<td>No con.</td>
<td>No pin</td>
<td>Vout 1</td>
<td>Vout 2</td>
</tr>
<tr>
<td>5</td>
<td>−Sense*</td>
<td>Vout 1</td>
<td>Common</td>
<td>Common</td>
</tr>
<tr>
<td>6</td>
<td>+Sense*</td>
<td>Common</td>
<td>No con.</td>
<td>Vout 3</td>
</tr>
<tr>
<td>7</td>
<td>+Vout</td>
<td>Common</td>
<td>No con.</td>
<td>Vout 1</td>
</tr>
<tr>
<td>8</td>
<td>−Vout</td>
<td>Vout 2</td>
<td>Vout 2</td>
<td>Common</td>
</tr>
<tr>
<td>9</td>
<td>Trim</td>
<td>Trim</td>
<td>Common</td>
<td>No con.</td>
</tr>
</tbody>
</table>

*Sense line to be connected to the output under regard of polarity

Dimensions in [mm], () = Inch
Pin diameter: 1.0 ±0.05 (0.04 ±0.002)
Pin pitch tolerances: ±0.35 (±0.014)
Case tolerances: ±0.5 (±0.02)

Heat-sink TEN-HS3

Order code: TEN-HS3
(cont.: heat-sink, thermal pad, 2 clamps)
Material: Aluminum
Finish: Anodic treatment (black)
Weight: 22 g (0.78 oz) (without converter)

Note:
The product label on converter has to be removed before mounting the heat-sink.
For volume orders converters will be supplied with heat-sinks already mounted. Please contact factory for quotation.
Separate heat-sinks are only available for prototypes and small quantity orders.