DC/DC Converters
TEN 40N Series, 40 Watt

Features
◆ Highest power density:
  40 W in 1” x 2” x 0.4” package
◆ Excellent efficiency up to 92 %
◆ Output voltage adjustable
◆ Remote On/Off
◆ Short circuit protection
◆ Over voltage protection
◆ I/O isolation 1500 VDC
◆ Operating temperature range
  -40°C to +80°C
◆ Fully RoHS compliant
◆ 3-year product warranty

The TEN 40N Series is a new range of isolated high performance dc-dc converter modules. Due to the very high efficiency of up to 92% these 40 W converters come with a footprint of only 1.0” x 2.0”. The 15 models have a wide 2:1 input voltage range and a tight output voltage regulation. The output voltage is adjustable by external resistor. Remote On/Off and protection against overpower and overvoltage are standard features of these converters.

Typical applications are in mobile equipment, instrumentation, distributed power architectures in communication and industrial electronics and everywhere where space on the PCB is critical.

Models

<table>
<thead>
<tr>
<th>Order code</th>
<th>Input voltage range</th>
<th>Output voltage</th>
<th>Output current max.</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEN 40-1210N</td>
<td>3.3 VDC</td>
<td>8’000 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-1211N</td>
<td>5.0 VDC</td>
<td>8’000 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-1212N</td>
<td>12 VDC</td>
<td>3’330 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-1213N</td>
<td>15 VDC</td>
<td>2’670 mA</td>
<td>90 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-1215N</td>
<td>24 VDC</td>
<td>1’670 mA</td>
<td>91 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-1222N</td>
<td>±12 VDC</td>
<td>±1’670 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-1223N</td>
<td>±15 VDC</td>
<td>±1’330 mA</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-2410N</td>
<td>3.3 VDC</td>
<td>8’000 mA</td>
<td>90 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-2411N</td>
<td>5.0 VDC</td>
<td>8’000 mA</td>
<td>91 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-2412N</td>
<td>12 VDC</td>
<td>3’330 mA</td>
<td>91 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-2413N</td>
<td>15 VDC</td>
<td>2’670 mA</td>
<td>91 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-2415N</td>
<td>24 VDC</td>
<td>1’670 mA</td>
<td>91 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-2422N</td>
<td>±12 VDC</td>
<td>±1’670 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-2423N</td>
<td>±15 VDC</td>
<td>±1’330 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-4810N</td>
<td>3.3 VDC</td>
<td>8’000 mA</td>
<td>90 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-4811N</td>
<td>5.0 VDC</td>
<td>8’000 mA</td>
<td>91 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-4812N</td>
<td>12 VDC</td>
<td>3’330 mA</td>
<td>92 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-4813N</td>
<td>15 VDC</td>
<td>2’670 mA</td>
<td>92 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-4815N</td>
<td>24 VDC</td>
<td>1’670 mA</td>
<td>91 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-4822N</td>
<td>±12 VDC</td>
<td>1’670 mA</td>
<td>89 %</td>
<td></td>
</tr>
<tr>
<td>TEN 40-4823N</td>
<td>±15 VDC</td>
<td>1’330 mA</td>
<td>89 %</td>
<td></td>
</tr>
</tbody>
</table>

www.tracopower.com
**Input Specifications**

<table>
<thead>
<tr>
<th>Input current at no load (nominal input voltage)</th>
<th>12 Vin; 3.3 VDC models: 120 mA typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Vin; 5.0, 12 &amp; 24 VDC models: 160 mA typ.</td>
<td>15 VDC models: 150 mA typ.</td>
</tr>
<tr>
<td>12 Vin; 12 &amp; 15 VDC dual output models: 70 mA typ. / 60 mA typ.</td>
<td></td>
</tr>
<tr>
<td>24 Vin; 3.3 &amp; 15 VDC models: 75 mA typ.</td>
<td>24 Vin; 5.0, 12 &amp; 24 VDC models: 80 mA typ. / 85 mA typ.</td>
</tr>
<tr>
<td>24 Vin; 12 &amp; 15 VDC dual output models: 50 mA typ. / 45 mA typ.</td>
<td></td>
</tr>
<tr>
<td>48 Vin; 3.3 VDC models: 40 mA typ.</td>
<td>48 Vin; other single output models: 50 mA typ.</td>
</tr>
<tr>
<td>48 Vin; dual output models: 65 mA typ.</td>
<td></td>
</tr>
</tbody>
</table>

**Surge voltage** *(100 ms max.)*

| 12 Vin models: 25 V max.                        | 24 Vin models: 50 V max.                        |
| 48 Vin models: 100 V max.                      |                                      |

**Reflected input ripple current**

| 12 Vin models: 50 mA typ.                      | 24 Vin models: 30 mA typ.                      |
| 48 Vin models: 20 mA typ.                      |                                      |

**Start-up voltage / under voltage shut down**

| 12 Vin models: 9.0 VDC max. / 8.3 VDC typ.     | 24 Vin models: 18 VDC max. / 16.5 VDC typ.     |
| 48 Vin models: 36 VDC / 33 VDC typ.            |                                      |

**Recommended input fuse** *(slow blow)*

| 12 Vin models: 8000 mA                          | 24 Vin models: 4000 mA                          |
| 48 Vin models: 2000 mA                          |                                      |

**Conducted noise** *(input)*

EN 55032 class A with external components see application note

**EMC immunity**

- ESD (electrostatic discharge)
  EN 61000-4-2, air ±8 kV, contact ±6 kV, perf. criteria B
- Radiated immunity
  EN 61000-4-3, 10 V/m, perf. criteria A
- Fast transient / surge (with external input capacitor)
  EN 61000-4-4, ±2 kV, perf. criteria A
  EN 61000-4-5, ±1 kV perf. criteria B
  Nippon chemicon KXG 330 µF, 200 V
- Conducted immunity
  EN 61000-4-6, 10 Vrms, perf. criteria A

**Output Specifications**

**Voltage set accuracy**

±1.0 %

**Output voltage adjustment range**

| 24 VDC models: +20 / –10 %                      | other models: ±10 % with external resistor (see page 3) |

**Regulation**

- Input variation: Vin min. to Vin max.
  0.5 % max.
- Load variation: single output models (0 – 100 %)
  0.5 % max.
- dual output models balanced load (10 – 100 %)
  1.0 % max.

**Minimum load**

| single output models: 0 %                        | 10 % of rated max current (operation at lower load condition will not damage the converters. However, they may not meet all listed specifications) |
| dual output models: 10 % of rated max current   |                                      |

**Temperature coefficient**

±0.02 %/K

**Ripple and noise** *(20 MHz Bandwidth)*

| 3.3 & 5.0 VDC models: 100 mVpk-pk. typ.          | other models: 150 mVpk-pk. typ.          |
| with external capacitors 1 µF M/C 10 µF T/C      |                                      |

**Transient response** *(25 % load step change)*

250 µs typ.

**Output current limitation**

110 % – 150 % of Iout max.

**Short circuit protection**

| 24 VDC models: 0.3 Hz. typ.                      | hiccup mode 1.5 Hz, automatic recovery |
| other models: hiccup mode 1.5 Hz, automatic recovery |                                      |

**Capacitive load**

| 3.3 VDC models: 21'000 µF max.                  | 5.0 VDC models: 13'600 µF max.                  |
| 12.0 VDC models: 2'400 µF max.                  | 15.0 VDC models: 1'500 µF max.                  |
| 24.0 VDC models: 600 µF max.                     | ±12.0 VDC models: 1'200 µF max.                     |
| ±15.0 VDC models: 750 µF max.                     |                                      |

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

Temperature ranges
- Operating (natural convection cooling 20 LFM) -40°C to +80°C (see load derating)
- Case temperature +105°C max.
- Storage -50°C to +125°C

Load derating
- without heatsink 3.3 VDC models: 2.5 %/K above 66°C
  other single output models: 1.6 %/K above 46°C
dual output models: 1.5 %/K above 40°C
- with heatsink 3.3 VDC models: 3.1 %/K above 73°C
  other single output models: 2.0 %/K above 57°C
dual output models: 1.9 %/K above 52°C

Over temperature protection at +110°C typ.

Humidity (non condensing) 95 % rel H max.

Reliability, calculated MTBF [MIL-HDBK-217F, at +25°C, ground benign] 328,000 h

Isolation voltage [60 s] - Input/Output 1500 VDC

Isolation capacitance - Input/Output 1500 pF typ.

Isolation resistance - Input/Output >1000 Mohm

Switching frequency (fixed) 24 VDC models: 285 kHz typ.
other models: 320 kHz typ. [pulse width modulation PWM]

Altitude during operation 5'000 m max. [16,400 ft] approved

Safety standards
- UL 62368-1
- CAN/CSA-C22.2 No 60950-1-07 + Am1:2011
- UL 60950-1, (2nd Ed) + Am1:2011

- Certification documents www.tracopower.com/overview/ten40n

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

Physical Specifications

Casing material aluminum
Potting material epoxy [UL 94V-0 rated]

Weight 30 g (1.05 oz)

Soldering temperature 260°C / 10 s max.

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

Application note: www.tracopower.com/overview/ten40n

Output Voltage Adjustment

Trim up

DC/DC
+Vout
Trim
−Vout

Ru [kohm]*
output 3.3V 5V 12V 15V 24V
+5% 7.34 12.30 41.40 50.15 27.38
+10% 0.65 0.48 2.70 3.58 0.34

Trim down

DC/DC
+Vout
Trim
−Vout

Ru [kohm]*
output 3.3V 5V 12V 15V 24V
−5% 8.51 16.53 47.15 63.35 38.04
−10% 0.50 1.24 1.35 4.92 1.12

*approximate values

All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.
**DC/DC Converters**  
**TEN 40N Series**  
**40 Watt**

### Outline Dimensions

- Bottom View

#### Pin-Out

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
<th>Dual</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+Vin (Vcc)</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>2</td>
<td>–Vin (GND)</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>3</td>
<td>Remote On/Off</td>
<td>Remote On/Off</td>
</tr>
<tr>
<td>4</td>
<td>+Vout</td>
<td>+Vout</td>
</tr>
<tr>
<td>5</td>
<td>–Vout</td>
<td>Common</td>
</tr>
<tr>
<td>6</td>
<td>Trim</td>
<td>–Vout</td>
</tr>
</tbody>
</table>

Dimensions in [mm], () = Inch  
Pin diameter: 1.0 ± 0.05 (0.04 ± 0.002)  
Pin pitch tolerance: ± 0.13 (± 0.005)  
Case tolerances: ± 0.25 (± 0.01)

---

### Heat-sink (optional)

- Material: Aluminium  
- Finish: Anodic treatment (black)

**Order code:**  
- TEN HS6 for 24 VDC output models  
- TEN-HS4 for other models  
(cont.: heat-sink, thermal pad, 2 clamps)

- Weight: 9 g (0.32oz) without converter
- Thermal impedance after assembling: 10 K/W

**Note:**  
Before attaching the heatsink, the product label on converter has to be removed for optimal performance. For volume orders we can supply the converters with heatsink already mounted. Please contact us for a relative quotation.

Specifications can be changed without notice! Make sure you are using the latest documentation, downloadable at www.tracopower.com

---

* 11.0mm (0.43 inch) for 24V Output Models

---

H = 18.0 (0.71) for 24 VDC output model with TEN-HS6
H = 17.2 (0.68) for other models with TEN-HS4