

- 40 Watt in a 2"x2" package
- Wide 2:1 input voltage range
- Extended operating temperature range: -40°C to +75°C
- Over temperature protection, under voltage lockout and Remote On/Off
- Shielded metal case with insulated baseplate
- 3-year product warranty



The TEN 40 series is a family of high performance 40W DC/DC converter modules featuring a wide 2:1 input voltage range in a 2"x2" package. Typical applications for these products are battery operated equipment and distributed power architectures in communication and industrial electronics.

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 40-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	8'000 mA					86 %
TEN 40-1211		5 VDC	8'000 mA					86 %
TEN 40-1212		12 VDC	3'300 mA					86 %
TEN 40-1220		+3.3 VDC	8'000 mA	+5 VDC	8'000 mA			85 %
TEN 40-1222		+12 VDC	1'800 mA	-12 VDC	1'800 mA			85 %
TEN 40-1223		+15 VDC	1'400 mA	-15 VDC	1'400 mA			85 %
TEN 40-1233		+3.3 VDC	6'000 mA	+12 VDC	400 mA	-12 VDC	400 mA	84 %
TEN 40-1234		+3.3 VDC	6'000 mA	+15 VDC	300 mA	-15 VDC	300 mA	84 %
TEN 40-1231		+5 VDC	6'000 mA	+12 VDC	400 mA	-12 VDC	400 mA	86 %
TEN 40-1232		+5 VDC	6'000 mA	+15 VDC	300 mA	-15 VDC	300 mA	86 %
TEN 40-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	8'000 mA					87 %
TEN 40-2411		5 VDC	8'000 mA					89 %
TEN 40-2412		12 VDC	3'300 mA					88 %
TEN 40-2420		+3.3 VDC	8'000 mA	+5 VDC	8'000 mA			86 %
TEN 40-2422		+12 VDC	1'800 mA	-12 VDC	1'800 mA			87 %
TEN 40-2423		+15 VDC	1'400 mA	-15 VDC	1'400 mA			87 %
TEN 40-2433		+3.3 VDC	6'000 mA	+12 VDC	400 mA	-12 VDC	400 mA	85 %
TEN 40-2434		+3.3 VDC	6'000 mA	+15 VDC	300 mA	-15 VDC	300 mA	85 %
TEN 40-2431		+5 VDC	6'000 mA	+12 VDC	400 mA	-12 VDC	400 mA	87 %
TEN 40-2432		+5 VDC	6'000 mA	+15 VDC	300 mA	-15 VDC	300 mA	87 %
TEN 40-4810	36 - 75 VDC (48 VDC nom.)	3.3 VDC	8'000 mA					88 %
TEN 40-4811		5 VDC	8'000 mA					90 %
TEN 40-4812		12 VDC	3'300 mA					89 %
TEN 40-4820		+3.3 VDC	8'000 mA	+5 VDC	8'000 mA			88 %
TEN 40-4822		+12 VDC	1'800 mA	-12 VDC	1'800 mA			87 %
TEN 40-4823		+15 VDC	1'400 mA	-15 VDC	1'400 mA			87 %
TEN 40-4833		+3.3 VDC	6'000 mA	+12 VDC	400 mA	-12 VDC	400 mA	86 %
TEN 40-4834		+3.3 VDC	6'000 mA	+15 VDC	300 mA	-15 VDC	300 mA	86 %
TEN 40-4831		+5 VDC	6'000 mA	+12 VDC	400 mA	-12 VDC	400 mA	88 %
TEN 40-4832		+5 VDC	6'000 mA	+15 VDC	300 mA	-15 VDC	300 mA	88 %

Options	
TEN-HS3	- Optional Heat Sink: <a href="http://www.tracopower.com/products/ten-hs3.pdf">www.tracopower.com/products/ten-hs3.pdf</a>

Note - TEN 40-xx20: Dynamic current allocation, 8 A total output current for both outputs together

## Input Specifications

Input Current	- At no load	12 Vin models: <b>200 mA typ.</b> 24 Vin models: <b>80 mA typ.</b> 48 Vin models: <b>50 mA typ.</b>
	- At full load	12 Vin models: <b>2'680 mA typ.</b> (3.3 Vout model) <b>4'065 mA typ.</b> (5 Vout model) <b>4'065 mA typ.</b> (12 Vout model) <b>3'415 mA typ.</b> (3.3 / 5 Vout model) <b>4'400 mA typ.</b> (12 / -12 Vout model) <b>4'400 mA typ.</b> (15 / -15 Vout model) <b>3'000 mA typ.</b> (3.3 / 12 / -12 Vout model) <b>3'000 mA typ.</b> (3.3 / 15 / -15 Vout model) <b>4'000 mA typ.</b> (5 / 12 / -12 Vout model) <b>4'000 mA typ.</b> (5 / 15 / -15 Vout model) 24 Vin models: <b>1'325 mA typ.</b> (3.3 Vout model) <b>2'000 mA typ.</b> (5 Vout model) <b>2'000 mA typ.</b> (12 Vout model) <b>1'685 mA typ.</b> (3.3 / 5 Vout model) <b>2'100 mA typ.</b> (12 / -12 Vout model) <b>2'100 mA typ.</b> (15 / -15 Vout model) <b>1'500 mA typ.</b> (3.3 / 12 / -12 Vout model) <b>1'500 mA typ.</b> (3.3 / 15 / -15 Vout model) <b>1'990 mA typ.</b> (5 / 12 / -12 Vout model) <b>1'990 mA typ.</b> (5 / 15 / -15 Vout model) 48 Vin models: <b>655 mA typ.</b> (3.3 Vout model) <b>1'000 mA typ.</b> (5 Vout model) <b>1'000 mA typ.</b> (12 Vout model) <b>825 mA typ.</b> (3.3 / 5 Vout model) <b>1'050 mA typ.</b> (12 / -12 Vout model) <b>1'050 mA typ.</b> (15 / -15 Vout model) <b>750 mA typ.</b> (3.3 / 12 / -12 Vout model) <b>750 mA typ.</b> (3.3 / 15 / -15 Vout model) <b>980 mA typ.</b> (5 / 12 / -12 Vout model) <b>980 mA typ.</b> (5 / 15 / -15 Vout model)
Surge Voltage		12 Vin models: <b>36 VDC max.</b> (100 ms max.) 24 Vin models: <b>50 VDC max.</b> (100 ms max.) 48 Vin models: <b>100 VDC max.</b> (100 ms max.)
Under Voltage Lockout		12 Vin models: <b>7 VDC min. / 8 VDC typ. / 8.8 VDC max.</b> 24 Vin models: <b>15 VDC min. / 16 VDC typ. / 17.5 VDC max.</b> 48 Vin models: <b>32.5 VDC min. / 34 VDC typ. / 35.5 VDC max.</b>
Recommended Input Fuse		12 Vin models: <b>8'000 mA</b> (fast acting) 24 Vin models: <b>4'000 mA</b> (slow blow) 48 Vin models: <b>2'000 mA</b> (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		<b>Internal LC-Type</b>

## Output Specifications

Output Voltage Adjustment	<b>±10%</b> (single output and dual symmetric output models only) (By external trim resistor) See application note: <a href="http://www.tracopower.com/overview/ten40">www.tracopower.com/overview/ten40</a> Output power must not exceed rated power!
Voltage Set Accuracy	<b>±1% max.</b> (±5% for triple models, (aux))

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>0.5% max.</b> dual output models: <b>0.5% max.</b> triple output models: <b>1% max.</b> <b>5% max. (aux)</b>
	- Load Variation (0 - 100%)	single output models: <b>0.5% max.</b> dual output models: <b>1% max. (Output 1)</b> <b>1% max. (Output 2)</b> triple output models: <b>2% max. (Output 1)</b> <b>5% max. (Output 2)</b> <b>5% max. (Output 3)</b>
	- Cross Regulation (25% / 100% asym. load)	dual output models: <b>5% max.</b> triple output models: <b>1% max.</b> <b>5% max. (aux)</b>
<b>Ripple and Noise</b> (20 MHz Bandwidth)	- single output	3.3 Vout: <b>50 mVp-p typ.</b> (w/ 0.1 $\mu$ F MLCC) 5 Vout: <b>50 mVp-p typ.</b> (w/ 0.1 $\mu$ F MLCC) 12 Vout: <b>75 mVp-p typ.</b> (w/ 0.1 $\mu$ F MLCC)
	- dual output	3.3 / 5 Vout: <b>100 / 100 mVp-p typ.</b> (w/ 1 $\mu$ F MLCC) 12 / -12 Vout: <b>120 / 120 mVp-p typ.</b> (w/ 0.1 $\mu$ F MLCC) 15 / -15 Vout: <b>150 / 150 mVp-p typ.</b> (w/ 0.1 $\mu$ F MLCC)
	- triple output	3.3 / 12 / -12 Vout: <b>50 / 75 / 75 mVp-p typ.</b> (w/ 0.1 $\mu$ F MLCC) 3.3 / 15 / -15 Vout: <b>50 / 75 / 75 mVp-p typ.</b> (w/ 0.1 $\mu$ F MLCC) 5 / 12 / -12 Vout: <b>50 / 75 / 75 mVp-p typ.</b> (w/ 0.1 $\mu$ F MLCC) 5 / 15 / -15 Vout: <b>50 / 75 / 75 mVp-p typ.</b> (w/ 0.1 $\mu$ F MLCC)
<b>Capacitive Load</b>	- single output	3.3 Vout: <b>21'000 <math>\mu</math>F max.</b> 5 Vout: <b>13'600 <math>\mu</math>F max.</b> 12 Vout: <b>2'360 <math>\mu</math>F max.</b>
	- dual output	3.3 / 5 Vout: <b>11'000 / 6'800 <math>\mu</math>F max.</b> 12 / -12 Vout: <b>1'200 / 1'200 <math>\mu</math>F max.</b> 15 / -15 Vout: <b>750 / 750 <math>\mu</math>F max.</b>
	- triple output	3.3 / 12 / -12 Vout: <b>13'000 / 330 / 330 <math>\mu</math>F max.</b> 3.3 / 15 / -15 Vout: <b>13'000 / 110 / 110 <math>\mu</math>F max.</b> 5 / 12 / -12 Vout: <b>6'800 / 330 / 330 <math>\mu</math>F max.</b> 5 / 15 / -15 Vout: <b>6'800 / 110 / 110 <math>\mu</math>F max.</b>
<b>Minimum Load</b>	- single output	3.3 Vout: <b>0 % of Iout max.</b> 5 Vout: <b>0 % of Iout max.</b> 12 Vout: <b>0 % of Iout max.</b>
	- dual output	3.3 / 5 Vout: <b>0 % of Iout max.</b> 12 / -12 Vout: <b>8 % of Iout max.</b> 15 / -15 Vout: <b>8 % of Iout max.</b>
	- triple output	3.3 / 12 / -12 Vout: <b>10 % of Iout max.</b> 3.3 / 15 / -15 Vout: <b>10 % of Iout max.</b> 5 / 12 / -12 Vout: <b>10 % of Iout max.</b> 5 / 15 / -15 Vout: <b>10 % of Iout max.</b>
<b>Temperature Coefficient</b>		<b><math>\pm 0.02</math> %/K max.</b>
<b>Start-up Time</b>		<b>25 ms typ.</b> (Power On) <b>25 ms typ.</b> (Remote On)
<b>Short Circuit Protection</b>		<b>Continuous, Automatic recovery</b>
<b>Output Current Limitation</b>		<b>150% max. of Iout max.</b>
<b>Overvoltage Protection</b>		<b>118 - 125% of Vout nom.</b> (depending on model) <b>3.9 VDC typ.</b> (3.3 VDC outputs) <b>6.2 VDC typ.</b> (5 VDC outputs) <b>15 VDC typ.</b> (12 VDC outputs) <b>18 VDC typ.</b> (15 VDC outputs) (By Zener diode)
<b>Transient Response</b>	- Response Time	<b>250 <math>\mu</math>s typ.</b> (25% Load Step)

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

### Safety Specifications

Standards	- IT / Multimedia Equipment	EN 60950-1 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1
	- Certification Documents	<a href="http://www.tracopower.com/overview/ten40">www.tracopower.com/overview/ten40</a>
Pollution Degree		PD 2
Over Voltage Category		Not mains connected

### EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55032 class A (with external filter) EN 55032 class B (with external filter)
	- Radiated Emissions	EN 55032 class A (with external filter) EN 55032 class B (with external filter)
	External filter proposal:	<a href="http://www.tracopower.com/overview/ten40">www.tracopower.com/overview/ten40</a>
EMS Immunity		EN 55024 (IT Equipment) EN 55035 (Multimedia)
	- Electrostatic Discharge	Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria B Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria B
	- RF Electromagnetic Field	EN 61000-4-3, 10 V/m, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-4, $\pm 2$ kV, perf. criteria B EN 61000-4-5, $\pm 1$ kV, perf. criteria B
	- Conducted RF Disturbances	Ext. input component: 220 $\mu$ F / 100 V / KY EN 61000-4-6, 10 Vrms, perf. criteria A
	- PF Magnetic Field	Continuous: EN 61000-4-8, 100 A/m, perf. criteria A 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	+100°C max.
	- Storage Temperature	-55°C to +125°C
Power Derating	- High Temperature	Depending on model
	See application note:	<a href="http://www.tracopower.com/overview/ten40">www.tracopower.com/overview/ten40</a>
Over Temperature Protection Switch Off	- Protection Mode	115°C typ.
Cooling System		Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote (passive = on)	On: 3.5 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin
	- Off Idle Input Current	2.5 mA typ.
	- Remote Pin Input Current	-0.5 to 0.5 mA
Altitude During Operation		5'000 m max.
Switching Frequency		450 - 550 kHz (PWM) (500 kHz typ.) (Dual models, 3.3 VDC output)
		270 - 330 kHz (PWM) (300 kHz typ.) (other models / outputs)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s	1'600 VDC
	- Input to Case, 60 s	1'600 VDC
	- Output to Case, 60 s	1'600 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 M $\Omega$ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	1'000 pF max.
Reliability	- Calculated MTBF	920'000 h (MIL-HDBK-217F, ground benign)

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

Washing Process		According to Cleaning Guideline <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Environment	- Vibration  - Mechanical Shock  - Thermal Shock	MIL-STD-810F 7.6 g, 3 axis, 60 min, 20-2000 Hz MIL-STD-810F 40 g, 3 axis, half sine, 11 ms MIL-STD-810F
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 2"
Soldering Profile		Lead-Free Wave Soldering 265°C / 10 s max.
Weight		60 g
Thermal Impedance	- Case to Ambient	9.2 K/W typ. 7.6 K/W typ. (with Heat Sink)
Environmental Compliance	- REACH Declaration  - RoHS Declaration  - SCIP Reference Number	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> Exemptions: 7a, 7c-1 (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) 59d98b0b-fdf8-4da8-a96c-627ba766180b

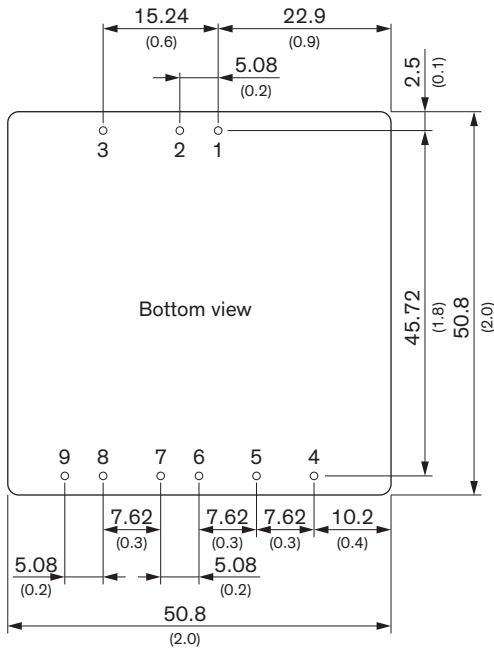
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/ten40](http://www.tracopower.com/overview/ten40)

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

**Outline Dimensions**



Dimensions in mm (inch)  
 Tolerance: x.xx ±0.05 (x.x ±0.02)  
 Tolerance: x.xxx ±0.25 (x.xx ±0.01)  
 Pin dimension tolerance ±0.10 (0.004)

Pinout				
Pin	Single	Dual symmetric	Dual asymmetric	Triple
1	+Vin (Vcc)	+Vin (Vcc)	+Vin (Vcc)	+Vin (Vcc)
2	-Vin (GND)	-Vin (GND)	-Vin (GND)	-Vin (GND)
3	Remote On/Off			
4	NC	No pin	Vout 1	Vout 2
5	-Sense*	Vout 1	Common	Common
6	+Sense*	Common	NC	Vout 3
7	+Vout	Common	NC	Vout 1
8	-Vout	Vout 2	Vout 2	Common
9	Trim	Trim	Common	NC

NC: Not connected

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