DC/DC Converter

TEN 20WIN Series, 20 Watt

- **2" x 1" x 0.4" metal package**
- **Ultra wide 4:1 input range**
- **Operating temperature range -40°C to +85°C**
- **I/O isolation 1500 VDC**
- **Input filter to meet EN 55022 class A**
- **Adjustable output voltage**
- **Remote On/Off**
- **3-year product warranty**

UL 62368-1 IEC 62368-1

The TEN 20WIN series is a family of high performance 20W DC/DC converter modules featuring ultra wide 4:1 input voltage ranges in a ultra compact 2“ x 1“ low profile package with industry-standard footprint. A very high efficiency allows an operating temperature range of –40°C to 85°C. Further standard features include remote On/Off, output voltage trimming, over voltage protection and short circuit protection. Typical applications for these converters are battery operated equipment and distributed power architectures in communication and industrial electronics, everywhere where isolated, tightly regulated voltages are required.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
TEN 20-2410WIN	9 - 36 VDC (24 VDC nom.)	3.3 VDC	5'500 mA			85 %
TEN 20-2411WIN		5 VDC	4'000 mA			88 %
TEN 20-2412WIN		12 VDC	1'670 mA			86 %
TEN 20-2413WIN		15 VDC	1'330 mA			86 %
TEN 20-2421WIN		+5 VDC	2'000 mA	–5 VDC	2'000 mA	88 %
TEN 20-2422WIN		+12 VDC	833 mA	–12 VDC	833 mA	87 %
TEN 20-2423WIN		+15 VDC	667 mA	–15 VDC	667 mA	87 %
TEN 20-4810WIN	18 - 75 VDC (48 VDC nom.)	3.3 VDC	5'500 mA			85 %
TEN 20-4811WIN		5 VDC	4'000 mA			88 %
TEN 20-4812WIN		12 VDC	1'670 mA			87 %
TEN 20-4813WIN		15 VDC	1'330 mA			87 %
TEN 20-4821WIN		+5 VDC	2'000 mA	–5 VDC	2'000 mA	89 %
TEN 20-4822WIN		+12 VDC	833 mA	–12 VDC	833 mA	88 %
TEN 20-4823WIN		+15 VDC	667 mA	–15 VDC	667 mA	88 %

Options

TEN-HS1	- Optional Heat Sink with Height = 0.22 inch: www.tracopower.com/overview/ten-hs1

Input Specifications

Input Current	- At no load	24 Vin models:	**50 mA typ.** (3.3 Vout model)
			65 mA typ. (5 Vout model)
			22 mA typ. (12 Vout model)
			22 mA typ. (15 Vout model)
			55 mA typ. (5 / -5 Vout model)
			30 mA typ. (12 / -12 Vout model)
			30 mA typ. (15 / -15 Vout model)
		48 Vin models:	**35 mA typ.** (3.3 Vout model)
			35 mA typ. (5 Vout model)
			15 mA typ. (12 Vout model)
			15 mA typ. (15 Vout model)
			35 mA typ. (5 / -5 Vout model)
			17 mA typ. (12 / -12 Vout model)
			17 mA typ. (15 / -15 Vout model)
	- At full load	24 Vin models:	**2'750 mA max.**
		48 Vin models:	**2'750 mA max.**
Surge Voltage		24 Vin models:	**50 VDC max.** (100 ms max.)
		48 Vin models:	**100 VDC max.** (100 ms max.)
Under Voltage Lockout		24 Vin models:	**7 VDC min. / 8 VDC typ. / 8.8 VDC max.**
		48 Vin models:	**14.5 VDC min. / 16 VDC typ. / 17.5 VDC max.**
Reflected Ripple Current			**20 mA typ.**
Recommended Input Fuse		24 Vin models:	**4'000 mA** (slow blow)
		48 Vin models:	**2'000 mA** (slow blow)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter			Internal Pi-Type

Output Specifications

Output Voltage Adjustment			**±10%** (By external trim resistor)
		See application note:	www.tracopower.com/overview/ten20win
			Output power must not exceed rated power!
Voltage Set Accuracy			**±1% max.**
Regulation	- Input Variation (Vmin - Vmax)	single output models:	**0.2% max.**
		dual output models:	**0.5% max.**
	- Load Variation (0 - 100%)	single output models:	**0.5% max.**
		dual output models:	**1% max.** (Output 1)
			1% max. (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models:	**5% max.**
Ripple and Noise (20 MHz Bandwidth)	- single output	3.3 Vout models:	**60 mVp-p typ.** (w/ 0.1 µF, 50 V MLCC)
		5 Vout models:	**75 mVp-p typ.** (w/ 0.1 µF, 50 V MLCC)
		12 Vout models:	**75 mVp-p typ.** (w/ 0.1 µF, 50 V MLCC)
		15 Vout models:	**75 mVp-p typ.** (w/ 0.1 µF, 50 V MLCC)
	- dual output	5 / -5 Vout models:	**100 / 100 mVp-p typ.** (w/ 0.1 µF, 50 V MLCC)
		12 / -12 Vout models:	**100 / 100 mVp-p typ.** (w/ 0.1 µF, 50 V MLCC)
		15 / -15 Vout models:	**100 / 100 mVp-p typ.** (w/ 0.1 µF, 50 V MLCC)
Capacitive Load	- single output	3.3 Vout models:	**18'000 µF max.**
		5 Vout models:	**9'600 µF max.**
		12 Vout models:	**1'650 µF max.**
		15 Vout models:	**1'050 µF max.**
	- dual output	5 / -5 Vout models:	**4'800 / 4'800 µF max.**
		12 / -12 Vout models:	**825 / 825 µF max.**
		15 / -15 Vout models:	**525 / 525 µF max.**
Minimum Load			Not required
Temperature Coefficient			**±0.02 %/K max.**

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

Start-up Time		20 ms typ. / 60 ms max.
Short Circuit Protection		Continuous, Automatic recovery
Overload Protection		Indefinite Mode
Output Current Limitation		125 - 170% of Iout max. 150% typ. of Iout max.
Overvoltage Protection		122% typ. of Vout nom. (depending on model) 3.9 VDC (3.3 VDC model) 6.2 VDC (5 / ±5 VDC model) 15 VDC (12 / ±12 VDC model) 18 VDC (15 / ±15 VDC model)
Transient Response	- Peak Variation	220 mV max. (25% Load Step)
	- Response Time	250 µs typ. (25% Load Step)

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	www.tracopower.com/overview/ten20win
Pollution Degree		PD 2
Over Voltage Category		Not mains connected

EMC Specifications

EMI (Emissions)			EN 61204-3 (Low Voltage Power Supplies)
	- 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:	www.tracopower.com/overview/ten20win
EMS (Immunity)			EN 61204-3 (Low Voltage Power Supplies)
	- Electrostatic Discharge	Air:	EN 61000-4-2, ±8 kV, perf. criteria B
		Contact:	EN 61000-4-2, ±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, ±2 kV, perf. criteria B EN 61000-4-5, ±1 kV, perf. criteria A
		Ext. input component:	KY 220 µF / 100 V
	- Conducted RF Disturbances		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 +85°C
	- Case Temperature		+105°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature		Depending on model
		See application note:	www.tracopower.com/overview/ten20win
Cooling System			Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote (passive = on)		On: 3.0 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.

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

Regulator Topology		Flyback Converter
Switching Frequency		360 - 440 kHz (PWM) 400 kHz typ. (PWM)
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 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	1'500 pF max.
Reliability	- Calculated MTBF	1'800'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F 7.7 g, 3 axis, random waveform, 60 min
	- Mechanical Shock	MIL-STD-810F 40 g, 3 axis, terminal peak sawtooth, 11 ms
	- Thermal Shock	MIL-STD-810F -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 260°C / 6 s max.
Weight		27 g
Thermal Impedance	- Case to Ambient	12 K/W typ. 10 K/W typ. (with Heat Sink)
Environmental Compliance	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	60396226-142c-440a-8dd3-fb6921d2b8f5

Additional Information

Supporting Documents	www.tracopower.com/overview/ten20win
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

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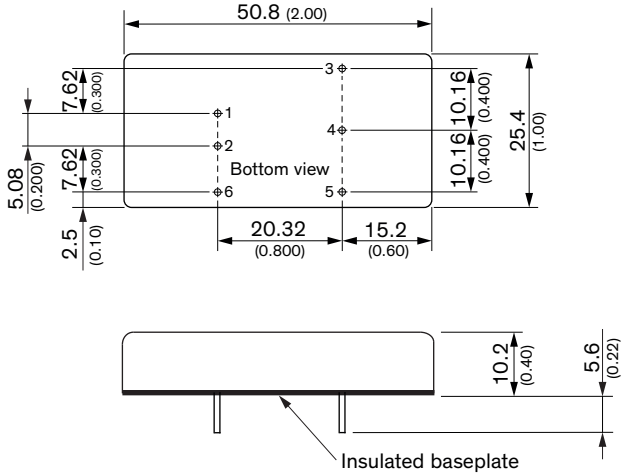
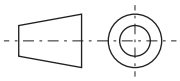
Outline Dimensions





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

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