THE DATASHEET OF

TEN 30-2433WIN

TRACO POWER

DC/DC Converter

TEN 30WIN Series, 30 Watt

- **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**

UL 62368-1 IEC 62368-1

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
		Vnom	Imax	Vnom	Imax	Vnom	Imax	typ.
TEN 30-2410WIN	9 - 36 VDC (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 (48 VDC nom.)	3.3 VDC	7'500 mA					86 %
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: www.tracopower.com/products/ten-hs1.pdf
on demand (backorder with MOQ non stocking item)	- Optional model with 1.5 VDC / 8'500 mA Output and 9 - 36 VDC Input - Optional model with 2.5 VDC / 8'000 mA Output and 9 - 36 VDC Input - Optional model with 1.5 VDC / 8'500 mA Output and 18 - 75 VDC Input - 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:	**70 mA typ.** (1.5 Vout model)
			70 mA typ. (2.5 Vout model)
			85 mA typ. (3.3 Vout model)
			115 mA typ. (5.1 Vout model)
			20 mA typ. (12 Vout model)
			30 mA typ. (15 Vout model)
			90 mA typ. (5 / -5 Vout model)
			25 mA typ. (12 / -12 Vout model)
			25 mA typ. (15 / -15 Vout model)
			105 mA typ. (5 / 12 / -12 Vout model)
			105 mA typ. (5 / 15 / -15 Vout model)
			105 mA typ. (3.3 / 12 / -12 Vout model)
			105 mA typ. (3.3 / 15 / -15 Vout model)
		48 Vin models:	**30 mA typ.** (1.5 Vout model)
			45 mA typ. (2.5 Vout model)
			45 mA typ. (3.3 Vout model)
			65 mA typ. (5.1 Vout model)
			65 mA typ. (12 Vout model)
			50 mA typ. (15 Vout model)
			50 mA typ. (5 / -5 Vout model)
			15 mA typ. (12 / -12 Vout model)
			15 mA typ. (15 / -15 Vout model)
			55 mA typ. (5 / 12 / -12 Vout model)
			55 mA typ. (5 / 15 / -15 Vout model)
			55 mA typ. (3.3 / 12 / -12 Vout model)
			55 mA typ. (3.3 / 15 / -15 Vout model)
	- At full load	24 Vin models:	**4'000 mA max.**
		48 Vin models:	**2'000 mA max.**
			(at Vin min.)
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:	**15 VDC min. / 16 VDC typ. / 17.5 VDC max.**
Reflected Ripple Current			**20 mA typ.**
Recommended Input Fuse		24 Vin models:	**6'300 mA** (slow blow)
		48 Vin models:	**3'150 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%** (single output models only)
		(By external trim resistor)
	See application note:	www.tracopower.com/overview/ten30win
		Output power must not exceed rated power!
Voltage Set Accuracy		**±1% max.** (±5 % for auxilary outputs)

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

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

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 Iout max.
Overvoltage Protection		125% typ. of Vout nom. (depending on model) 2 VDC (1.5 Vout model) 3.3 VDC (2.5 Vout model) 3.9 VDC (3.3 Vout model) 6.2 VDC (5 / 5.1 Vout model) 15 VDC (12 Vout model) 18 VDC (15 Vout 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 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1
	- Certification Documents	www.tracopower.com/overview/ten30win
Pollution Degree		PD 2
Over Voltage Category		OVC I

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:	www.tracopower.com/overview/ten30win
EMS Immunity	- Electrostatic Discharge	Air:	EN 61000-4-2, ±8 kV, perf. criteria A
		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 EN 61000-4-5, ±1 kV, perf. criteria A
		Ext. input component:	24 Vin models: KY 330 µF / 50 V 48 Vin models: 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 +75°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/ten30win
Over Temperature Protection Switch Off	- Protection Mode	115°C max. (Automatic recovery at 105°C typ.)
	- Measurement Point	Case
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	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.

Regulator Topology		Flyback Converter
Switching Frequency		387 - 473 kHz (PWM) (single, dual output models) 360 - 440 kHz (PWM) (triple output models)
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	1'300'000 h (single and dual output models) 1'200'000 h (triple output models) (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F 7.6 g, 3 axis, 60 min, 20-2000 Hz
	- 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		30.5 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: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	6d4d2567-f4c4-424d-82c4-6afb32e4abf1

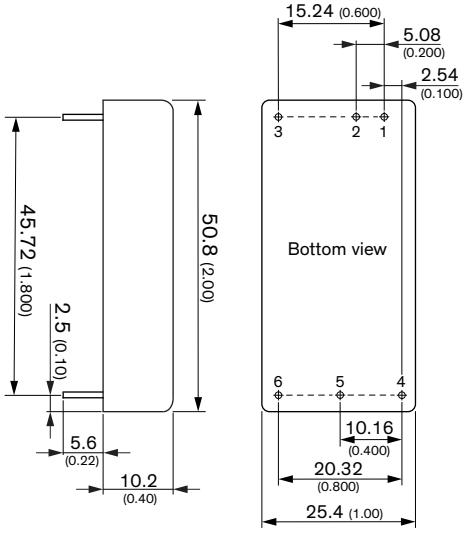
Supporting Documents

Overview Link (for additional Documents)	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

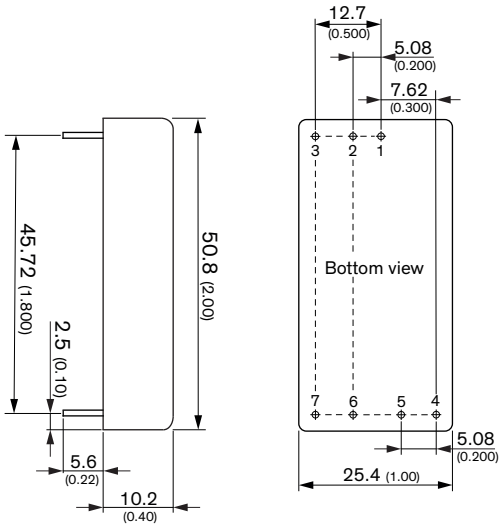
Single and dual output models



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

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)

Triple output models



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

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)

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