

- Compact design in THD Package
- Wide 2:1 input voltage range
- Fully regulated outputs
- Low ripple and noise
- Temperature range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  without derating
- I/O isolation 1600 VDC
- Continuous short-circuit protection
- Remote On/Off control
- Fully RoHS compliant
- 3-year product warranty



The TDR 2 series is a family of compact 2 W DC/DC-converters with 2:1 input voltage ranges and tightly regulated output voltages even under no load conditions. The product is available in THD-package. They work with high efficiency over the full load range and come with a remote On/Off input. The usability in temperature ranges of up to  $85^{\circ}\text{C}$  without power derating, continuous short circuit protection and excellent immunity against environmental influences make these converters very reliable. A TDR 2 converter is the ideal solution for space critical high end applications in communication equipment, instrumentation and industrial electronics.

Models						
Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
TDR 2-0511	4.5 - 9 VDC (5 VDC nom.)	5 VDC	400 mA			80 %
TDR 2-0512		12 VDC	167 mA			81 %
TDR 2-0513		15 VDC	134 mA			83 %
TDR 2-0522		+12 VDC	83 mA	-12 VDC	83 mA	81 %
TDR 2-0523		+15 VDC	67 mA	-15 VDC	67 mA	82 %
TDR 2-1211	9 - 18 VDC (12 VDC nom.)	5 VDC	400 mA			81 %
TDR 2-1212		12 VDC	167 mA			81 %
TDR 2-1213		15 VDC	134 mA			84 %
TDR 2-1222		+12 VDC	83 mA	-12 VDC	83 mA	83 %
TDR 2-1223		+15 VDC	67 mA	-15 VDC	67 mA	82 %
TDR 2-2411	18 - 36 VDC (24 VDC nom.)	5 VDC	400 mA			81 %
TDR 2-2412		12 VDC	167 mA			84 %
TDR 2-2413		15 VDC	134 mA			84 %
TDR 2-2422		+12 VDC	83 mA	-12 VDC	83 mA	84 %
TDR 2-2423		+15 VDC	67 mA	-15 VDC	67 mA	84 %
TDR 2-4811	36 - 75 VDC (48 VDC nom.)	5 VDC	400 mA			81 %
TDR 2-4812		12 VDC	167 mA			82 %
TDR 2-4813		15 VDC	134 mA			82 %
TDR 2-4822		+12 VDC	83 mA	-12 VDC	83 mA	83 %
TDR 2-4823		+15 VDC	67 mA	-15 VDC	67 mA	83 %

### Input Specifications

Input Current	- At no load	5 Vin models: <b>40 mA typ.</b> 12 Vin models: <b>20 mA typ.</b> 24 Vin models: <b>10 mA typ.</b> 48 Vin models: <b>7 mA typ.</b>
	- At full load	5 Vin models: <b>520 mA max.</b> 12 Vin models: <b>215 mA max.</b> 24 Vin models: <b>105 mA max.</b> 48 Vin models: <b>55 mA max.</b>
Surge Voltage		5 Vin models: <b>15 VDC max.</b> (1 s max.) 12 Vin models: <b>25 VDC max.</b> (1 s max.) 24 Vin models: <b>50 VDC max.</b> (1 s max.) 48 Vin models: <b>100 VDC max.</b> (1 s max.)
Reflected Ripple Current		5 Vin models: <b>80 mAp-p typ.</b> 12 Vin models: <b>40 mAp-p typ.</b> 24 Vin models: <b>30 mAp-p typ.</b> 48 Vin models: <b>20 mAp-p typ.</b>
Recommended Input Fuse		5 Vin models: <b>2'000 mA</b> (slow blow) 12 Vin models: <b>1'500 mA</b> (slow blow) 24 Vin models: <b>1'000 mA</b> (slow blow) 48 Vin models: <b>1'000 mA</b> (slow blow)  (The need of an external fuse has to be assessed in the final application.)
Input Filter		Internal Capacitor

### Output Specifications

Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (Vmin - Vmax)	single output models: <b>0.2% max.</b> dual output models: <b>0.2% max.</b>
	- Load Variation (0 - 100%)	single output models: <b>1% max.</b> dual output models: <b>1% max.</b> (Output 1) <b>1% max.</b> (Output 2)
	- Cross Regulation (25% / 100% asym. load)	dual output models: <b>5% max.</b>
Ripple and Noise	- 20 MHz Bandwidth	<b>30 mVp-p typ.</b>
Capacitive Load	- single output	5 Vout models: <b>1'680 µF max.</b> 12 Vout models: <b>820 µF max.</b> 15 Vout models: <b>680 µF max.</b>
	- dual output	12 / -12 Vout models: <b>470 / 470 µF max.</b> 15 / -15 Vout models: <b>330 / 330 µF max.</b>
Minimum Load		Not required
Temperature Coefficient		<b>±0.02 %/K max.</b>
Start-up Time		<b>5 ms typ.</b>
Short Circuit Protection		Continuous, Automatic recovery
Transient Response	- Response Time	<b>250 µs typ.</b> (25% Load Step)

### Safety Specifications

Safety 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/tdr2">www.tracopower.com/overview/tdr2</a>
Pollution Degree		PD 2

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

## 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/tdr2">www.tracopower.com/overview/tdr2</a>
EMS Immunity	- Electrostatic Discharge	Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A
	- RF Electromagnetic Field	EN 61000-4-3, 10 V/m, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-4, $\pm 2$ kV, perf. criteria A EN 61000-4-5, $\pm 1$ kV, perf. criteria A
	- Conducted RF Disturbances	Ext. input component: 220 $\mu$ F / 100 V 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 (without derating)
	- Case Temperature	+100°C max.
	- Storage Temperature	-55°C to +125°C
Power Derating	- High Temperature	6.67 %/K above 85°C
		See application note: <a href="http://www.tracopower.com/overview/tdr2">www.tracopower.com/overview/tdr2</a>
Cooling System		Natural convection (20 LFM)
Remote Control	- Current Controlled Remote	On: open circuit Off: 2 to 4 mA current (internal 1 k $\Omega$ resistor)
	- Off Idle Input Current	External circuit proposal: <a href="http://www.tracopower.com/info/current-remote.pdf">www.tracopower.com/info/current-remote.pdf</a> 2.5 mA max.
Altitude During Operation		5'000 m max.
Switching Frequency		100 - 1300 kHz (RCC)
Insulation System		Basic Insulation
Isolation Test Voltage	- Input to Output, 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	50 pF max.
Reliability	- Calculated MTBF	7'100'000 h (MIL-HDBK-217F, ground benign)
Washing Process		Allowed (hermetical product)
		See Cleaning Guideline: <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Environment	- Vibration	MIL-STD-810F
	- Thermal Shock	MIL-STD-810F
Housing Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Epoxy (UL 94 V-0 rated)
Pin Material		Copper
Pin Foundation Plating		Nickel (40 - 120 $\mu$ m)
Pin Surface Plating		Gold (25 - 75 nm), matte
Housing Type		Overmold
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		DIP14
Soldering Profile		Wave Soldering 265°C / 10 s max.
Weight		4.5 g

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

Environmental Compliance - REACH Declaration

[www.tracopower.com/info/reach-declaration.pdf](http://www.tracopower.com/info/reach-declaration.pdf)

REACH SVHC list compliant

REACH Annex XVII compliant

- RoHS Declaration

[www.tracopower.com/info/rohs-declaration.pdf](http://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).  
The SCIP number is provided on request.)

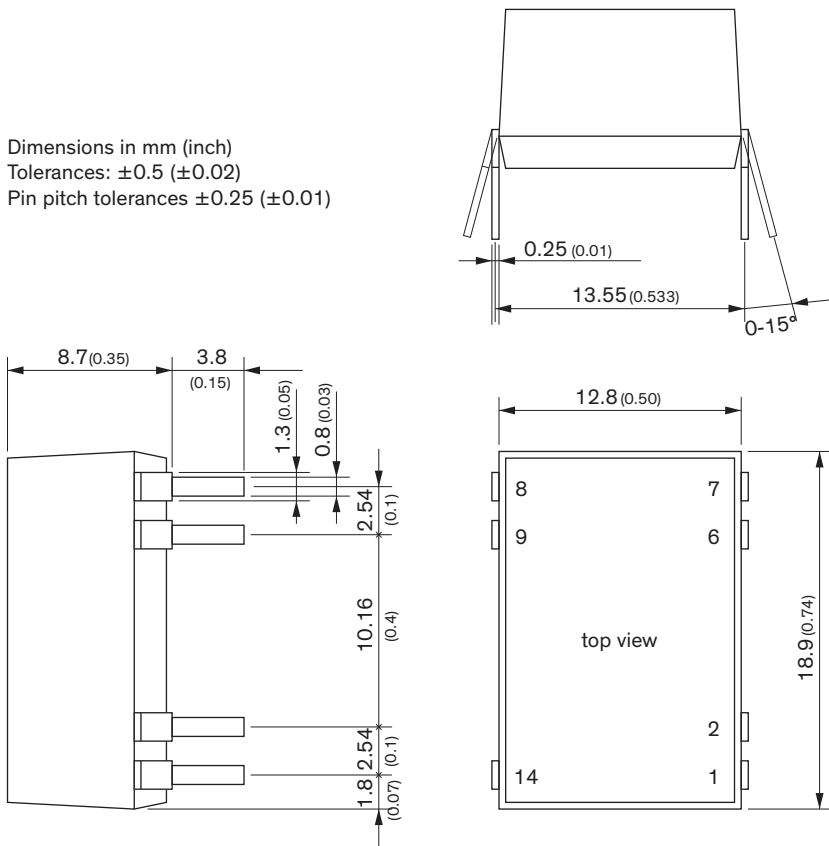
### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tdr2](http://www.tracopower.com/overview/tdr2)

### Outline Dimensions

Dimensions in mm (inch)  
Tolerances:  $\pm 0.5$  ( $\pm 0.02$ )  
Pin pitch tolerances  $\pm 0.25$  ( $\pm 0.01$ )



### Pinout

Pin	Single	Dual
1	-Vin (GND)	-Vin (GND)
2	Remote On/Off	Remote On/Off
6	NC	Common
7	NC	-Vout
8	+Vout	+Vout
9	-Vout	Common
14	+Vin (Vcc)	+Vin (Vcc)

NC: Not connected