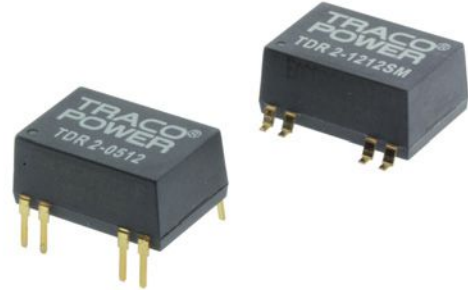


### Features

- ◆ Compact design in SMD or DIP package
- ◆ Wide 2:1 input voltage range
- ◆ Fully regulated outputs
- ◆ Low ripple and noise
- ◆ No minimum load required
- ◆ Temperature range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  without derating
- ◆ I/O isolation 1500 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 SMD-package or in DIP-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 DIP models	Order code SMD models	Input voltage range	Output voltage	Output current max.	Efficiency typ.
TDR 2-0511	TDR 2-0511SM	4.5 – 9.0 VDC (5 VDC nominal)	5.0 VDC	400 mA	80 %
TDR 2-0512	TDR 2-0512SM		12 VDC	167 mA	81 %
TDR 2-0513	TDR 2-0513SM		15 VDC	134 mA	83 %
TDR 2-0522	TDR 2-0522SM		$\pm 12$ VDC	$\pm 83$ mA	81 %
TDR 2-0523	TDR 2-0523SM		$\pm 15$ VDC	$\pm 67$ mA	82 %
TDR 2-1211	TDR 2-1211SM	9 – 18 VDC (12 VDC nominal)	5.0 VDC	400 mA	81 %
TDR 2-1212	TDR 2-1212SM		12 VDC	167 mA	81 %
TDR 2-1213	TDR 2-1213SM		15 VDC	134 mA	84 %
TDR 2-1222	TDR 2-1222SM		$\pm 12$ VDC	$\pm 83$ mA	83 %
TDR 2-1223	TDR 2-1223SM		$\pm 15$ VDC	$\pm 67$ mA	82 %
TDR 2-2411	TDR 2-2411SM	18 – 36 VDC (24 VDC nominal)	5.0 VDC	400 mA	81 %
TDR 2-2412	TDR 2-2412SM		12 VDC	167 mA	84 %
TDR 2-2413	TDR 2-2413SM		15 VDC	134 mA	84 %
TDR 2-2422	TDR 2-2422SM		$\pm 12$ VDC	$\pm 83$ mA	84 %
TDR 2-2423	TDR 2-2423SM		$\pm 15$ VDC	$\pm 67$ mA	84 %
TDR 2-4811	TDR 2-4811SM	36 – 75 VDC (48 VDC nominal)	5.0 VDC	400 mA	81 %
TDR 2-4812	TDR 2-4812SM		12 VDC	167 mA	82 %
TDR 2-4813	TDR 2-4813SM		15 VDC	134 mA	82 %
TDR 2-4822	TDR 2-4822SM		$\pm 12$ VDC	$\pm 83$ mA	83 %
TDR 2-4823	TDR 2-4823SM		$\pm 15$ VDC	$\pm 67$ mA	83 %

### Input Specifications

Input current at no load (nominal input voltage)	5 Vin models: 40 mA typ. 12 Vin models: 20 mA typ. 24 Vin models: 10 mA typ. 48 Vin models: 7 mA typ.
Input current at full load (nominal input voltage)	5 Vin models: 520 mA typ. 12 Vin models: 215 mA typ. 24 Vin models: 105 mA typ. 48 Vin models: 55 mA typ.
Surge voltage (1 sec. max.)	5 Vin models: 15 V max. 12 Vin models: 25 V max. 24 Vin models: 50 V max. 48 Vin models: 100 V max.
Input filter	capacitor type (see EMC considerations page 3 for compliance to EN 55022 class A/B)
ESD (electrostatic discharge)	EN 61000-4-2, air $\pm 8$ kV, contact $\pm 6$ kV, perf. criteria A
Radiated immunity	EN 61000-4-3 10 V/m, perf. criteria A
Fast transient / Surge	EN 61000-4-4, $\pm 2$ kV, perf. criteria A EN 61000-4-5, $\pm 1$ kV perf. criteria A with external input capacitor e.g. Nippon chemi-con KY 220 $\mu$ F, 100 V, ESR 48 mOhm
Conducted immunity	EN 61000-4-6, 10 Vrms, perf. criteria A
Reflected ripple current (measured with input filter according class A)	5 Vin models: 80 mA <sub>p-p</sub> typ. 12 Vin models: 40 mA <sub>p-p</sub> typ. 24 Vin models: 30 mA <sub>p-p</sub> typ. 48 Vin models: 20 mA <sub>p-p</sub> typ.

### Output Specifications

Voltage set accuracy	$\pm 1$ % max
Regulation	– Input variation Vin min. to Vin max. 0.2 % max. – Load variation 0 – 100 % single output models: 1.0 % max. dual output models: 1.0 % max. balanced load – Load variation 10 – 90 % single output models: 0.5 % max. dual output models: 0.8 % max. balanced load – Load cross regulation 25/100 % 5.0 % max. (dual output models)
Minimum load	0 % of rated max. load
Temperature coefficient	$\pm 0.02$ %/K
Ripple and noise (20 MHz bandwidth)	30 mV <sub>p-p</sub> typ.
Start up time	– Power On 5 ms typ. (constant resistive load) – Remote On 5 ms typ.
Transient response setting time (25 % load step change)	250 $\mu$ s typ.
Short circuit protection	indefinite, automatic recovery
Capacitive load	5 VDC models: 1680 $\mu$ F max. 12 VDC models: 820 $\mu$ F max. 15 VDC models: 680 $\mu$ F max. $\pm 12$ VDC models: $\pm 470$ $\mu$ F max. $\pm 15$ VDC models: $\pm 330$ $\mu$ F max.

### General Specifications

Temperature ranges	– Operating –40°C to +85°C (with no derating) – Storage –55°C to +125°C – Case temperature +100°C max.
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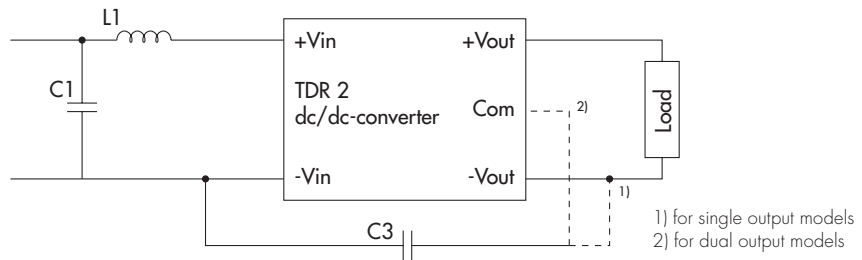
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

**General Specifications**

Humidity (non condensing)		5 % to 90 % rel. H max.
Thermal shock		acc. MIL-STD-810F
Vibration		acc. MIL-STD-810F
Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign)		>7.1 Mio h
Isolation voltage (60sec.)	- Input/Output	1500 VDC
Isolation capacitance	- Input/Output	50 pF max.
Isolation resistance	- Input/Output (500 VDC)	>10 GOhm
Altitude during operation		tba.
Safety standard (designed to meet)		IEC/EN 60950-1, UL 60950-1
Safety approvals	- UL/cUL	<a href="http://www.ul.com">www.ul.com</a> -> certifications -> File: e188913
Switching frequency		0.1...1.3 MHz
Remote On/Off	- On: - Off: - Off stand by input current	open or high impedance 2...4 mA current applied via 1KOhm resistor 2.5 mA max.
Environmental compliance	- Reach - RoHS	<a href="http://www.tracopower.com/overview/tdr2">www.tracopower.com/overview/tdr2</a> RoHS directive 2011/65/EU

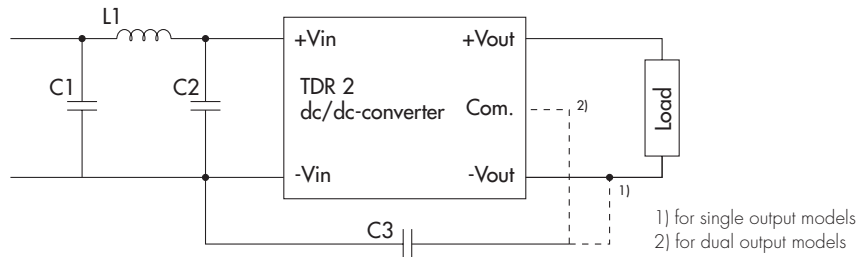
**EMC Consideration**

Recommended filter for EN 55022 class A compliance



Input models	C1	C3	L1 value	order code (SMD type)	datasheet
5 VDC	10 µF / 25 V 1812 MLCC	220pF / 3 kV 1808 MLCC	2.2 µH	TCK-059	<a href="http://www.tracopower.com/products/tck059.pdf">www.tracopower.com/products/tck059.pdf</a>
12 VDC	6.8 µF / 50 V 1812 MLCC		18 µH	TCK-046	<a href="http://www.tracopower.com/products/tck046.pdf">www.tracopower.com/products/tck046.pdf</a>
24 VDC	4.7 µF / 50 V 1812 MLCC				
48 VDC	4.7 µF / 100 V 1812 MLCC				

Recommended filter for EN 55022 class B compliance



Input models	C1 & C2	C3	L1 value	order code (SMD type)	datasheet
5 VDC	10 µF / 25 V 1812 MLCC	220pF / 3 kV 1808 MLCC	2.2 µH	TCK-059	<a href="http://www.tracopower.com/products/tck059.pdf">www.tracopower.com/products/tck059.pdf</a>
12 VDC	2.2 µF / 50 V 1812 MLCC		18 µH	TCK-046	<a href="http://www.tracopower.com/products/tck046.pdf">www.tracopower.com/products/tck046.pdf</a>
24 VDC			27 µH	TCK-063	<a href="http://www.tracopower.com/products/tck063.pdf">www.tracopower.com/products/tck063.pdf</a>
48 VDC			18 µH	TCK-046	<a href="http://www.tracopower.com/products/tck046.pdf">www.tracopower.com/products/tck046.pdf</a>

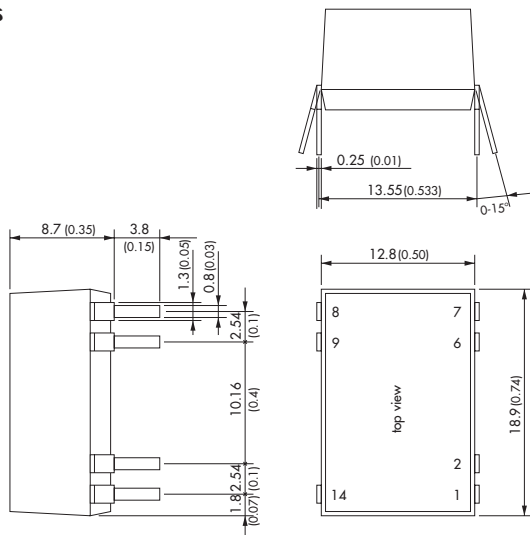
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

**Physical Specifications**

Casing material	non-conductive plastic (UL94V-0 rated)
Package weight	4.5 g (0.16 oz)
Soldering profile for DIP-package models	max. 265°C / 10 sec. (wave soldering)
Lead-free reflow solder process for SMD-package models	as per J-STD-020D.01 (to find at: <a href="http://www.jedec.org">www.jedec.org</a> - free registration required) 245°C
	- Peak package body temperature
Moisture sensitivity level (for SMD-package models)	level 2a as per J-STD-033B.01 (to find at: <a href="http://www.jedec.org">www.jedec.org</a> - free registration required)
Environmental compliance	- Reach - RoHS <a href="http://www.tracopower.com/overview/tdr2">www.tracopower.com/overview/tdr2</a> RoHS directive 2011/65/EU
Packaging	- Tube - Tape & Reel (only SMD models, add suffix -TR) 10 pcs packing unit 200 pcs packing unit

**Outline Dimensions**

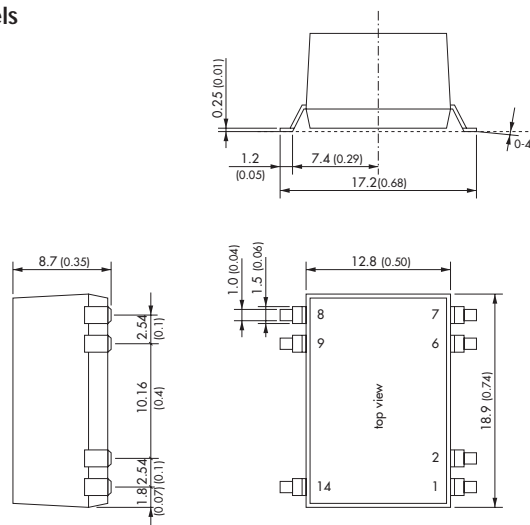
**DIP-Models**



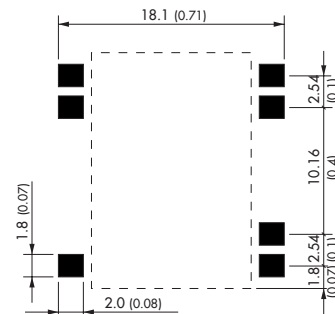
Pin-Out		
Pin	Single	Dual
1	-Vin (GND)	-Vin (GND)
2	Remote On/Off	Remote On/Off
6	NC	Common
7	NC	-Vout
8	+Vout	+Vout
9	-Vout	Common
14	+Vin (Vcc)	+Vin (Vcc)

NC = not to connect

**SMD-Models**



**Recommended Solder Pad Dimension:**



Dimensions in [mm], ( ) = Inch  
Tolerances: ±0.5 (±0.02)  
Pin pitch tolerances: ±0.25 (±0.01)

Specifications can be changed without notice! Make sure you are using the latest documentation, downloadable at [www.tracopower.com](http://www.tracopower.com)