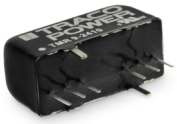
TRACO POWER

DC/DC Converter

TMR 9 Series, 9 Watt

- **Highest power density in SIP-8 metal package (optional plastic package)**
- **Wide 2:1 input voltage range**
- **Temperature range –40° to +85°C**
- **High efficiency up to 89%**
- **Indefinite short-circuit protection**
- **I/O isolation 1600 VDC**
- **Remote On/Off control**
- **Fully RoHS compliant**
- **3-year product warranty**



UL 62368-1 IEC 62368-1

The TMR 9 series is a new family of isolated 9W DC/DC converter modules with regulated output, featuring wide 2:1 input voltage ranges. The product comes in a ultra-compact SIP-8 metal package with a small footprint occupying only 2.0 cm² (0.3 square inch) of board space.
An excellent efficiency allows –40° to +60°C operation temperatures without derating. Further features include remote On/Off control and continuous short circuit protection. The very compact dimensions of these converters make them an ideal solution for many space critical applications in communication equipment, instrumentation and industrial electronics.

Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency
		Vnom	Imax	Vnom	Imax	typ.
TMR 9-1210	9 - 18 VDC (12 VDC nom.)	3.3 VDC	2'000 mA			81 %
TMR 9-1211		5 VDC	1'600 mA			85 %
TMR 9-1219		9 VDC	1'000 mA			87 %
TMR 9-1212		12 VDC	750 mA			88 %
TMR 9-1213		15 VDC	600 mA			89 %
TMR 9-1215		24 VDC	375 mA			89 %
TMR 9-1221		+5 VDC	800 mA	–5 VDC	800 mA	85 %
TMR 9-1222		+12 VDC	375 mA	–12 VDC	375 mA	88 %
TMR 9-1223		+15 VDC	300 mA	–15 VDC	300 mA	89 %
TMR 9-2410	18 - 36 VDC (24 VDC nom.)	3.3 VDC	2'000 mA			82 %
TMR 9-2411		5 VDC	1'600 mA			85 %
TMR 9-2419		9 VDC	1'000 mA			88 %
TMR 9-2412		12 VDC	750 mA			89 %
TMR 9-2413		15 VDC	600 mA			90 %
TMR 9-2415		24 VDC	375 mA			90 %
TMR 9-2421		+5 VDC	800 mA	–5 VDC	800 mA	86 %
TMR 9-2422		+12 VDC	375 mA	–12 VDC	375 mA	89 %
TMR 9-2423		+15 VDC	300 mA	–15 VDC	300 mA	87 %
TMR 9-4810	36 - 75 VDC (48 VDC nom.)	3.3 VDC	2'000 mA			82 %
TMR 9-4811		5 VDC	1'600 mA			85 %
TMR 9-4819		9 VDC	1'000 mA			88 %
TMR 9-4812		12 VDC	750 mA			89 %
TMR 9-4813		15 VDC	600 mA			89 %
TMR 9-4815		24 VDC	375 mA			89 %
TMR 9-4821		+5 VDC	800 mA	–5 VDC	800 mA	86 %
TMR 9-4822		+12 VDC	375 mA	–12 VDC	375 mA	87 %
TMR 9-4823		+15 VDC	300 mA	–15 VDC	300 mA	87 %

Options

on demand (backorder with MOQ non stocking item)	- Optional models with plastic case

Input Specifications

Input Current	- At no load	12 Vin models:	**11 mA typ.**
		24 Vin models:	**7 mA typ.**
		48 Vin models:	**3 mA typ.**
Surge Voltage		12 Vin models:	**36 VDC max.** (1 s max.)
		24 Vin models:	**50 VDC max.** (1 s max.)
		48 Vin models:	**100 VDC max.** (1 s max.)
Recommended Input Fuse		12 Vin models:	**3'150 mA** (slow blow)
		24 Vin models:	**2'500 mA** (slow blow)
		48 Vin models:	**1'250 mA** (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			±1% max.
Regulation	- Input Variation (Vmin - Vmax)	single output models:	0.2% max.
		dual output models:	0.2% max.
	- Load Variation (0 - 100%)	single output models:	1% 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:	**50 mVp-p typ.** (w/ 1 µF X7R)
		5 Vout models:	**50 mVp-p typ.** (w/ 1 µF X7R)
		9 Vout models:	**50 mVp-p typ.** (w/ 1 µF X7R)
		12 Vout models:	**75 mVp-p typ.** (w/ 1 µF X7R)
		15 Vout models:	**75 mVp-p typ.** (w/ 1 µF X7R)
		24 Vout models:	**75 mVp-p typ.** (w/ 1 µF X7R)
	- dual output	5 / -5 Vout models:	**50 / 50 mVp-p typ.** (w/ 1 µF X7R)
		12 / -12 Vout models:	**75 / 75 mVp-p typ.** (w/ 1 µF X7R)
		15 / -15 Vout models:	**75 / 75 mVp-p typ.** (w/ 1 µF X7R)
Capacitive Load	- single output	3.3 Vout models:	**2'600 µF max.**
		5 Vout models:	**1'300 µF max.**
		9 Vout models:	**800 µF max.**
		12 Vout models:	**560 µF max.**
		15 Vout models:	**560 µF max.**
		24 Vout models:	**200 µF max.**
	- dual output	5 / -5 Vout models:	**800 / 800 µF max.**
		12 / -12 Vout models:	**390 / 390 µF max.**
		15 / -15 Vout models:	**200 / 200 µF max.**
Minimum Load			Not required
Temperature Coefficient			±0.02 %/K max.
Start-up Time			50 ms typ.
Short Circuit Protection			Continuous, Automatic recovery
Output Current Limitation			180% typ. of Iout max.
Transient Response	- Response Time		**250 µs typ.** (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		www.tracopower.com/overview/tmr9
Pollution Degree			PD 2

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/tmr9
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, 20 V/m, perf. criteria A
	- EFT (Burst) / Surge		EN 61000-4-4, ±2 kV, perf. criteria A
			EN 61000-4-5, ±2 kV, perf. criteria A
		Ext. input component:	24 Vin models: KY 220 µF || SMDJ70A 48 Vin models: KY 220 µF || SMDJ120A
	- 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

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +85°C
	- Case Temperature		+100°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature		Depending on model
		See application note:	www.tracopower.com/overview/tmr9
Cooling System			Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote (passive = on)		On: 0 to 0.5 VDC or open circuit Off: 3 to 12 VDC Refers to 'Remote' and '-Vin' Pin
	- Off Idle Input Current		2.5 mA typ.
	- Remote Pin Input Current		0.5 to 2.5 mA
Altitude During Operation			5'000 m max.
Regulator Topology			Flyback Converter
Switching Frequency			400 kHz typ. (PWM) (single output models) 500 kHz typ. (PWM) (dual output models)
Insulation System			Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s		1'600 VDC
	- Input to Case, 60 s		1'000 VDC
Isolation Resistance	- Input to Output, 500 VDC		1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V		50 pF max.
Reliability	- Calculated MTBF		2'940'000 h (for standard version) 2'700'000 h (for plastic version) (MIL-HDBK-217F, ground benign)
Washing Process			According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration		MIL-STD-810F
	- Thermal Shock		MIL-STD-810F

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

Housing Material		Copper (for standard version) Non-conductive plastic (for plastic version)
Potting Material		Silicone (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		SIP8
Soldering Profile		Lead-Free Wave Soldering 260°C / 6 s max.
Weight		5.9 g (for standard version) 4.8 g (for plastic version)
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	a0c3442b-7838-4ff2-befa-e4362c1436dc

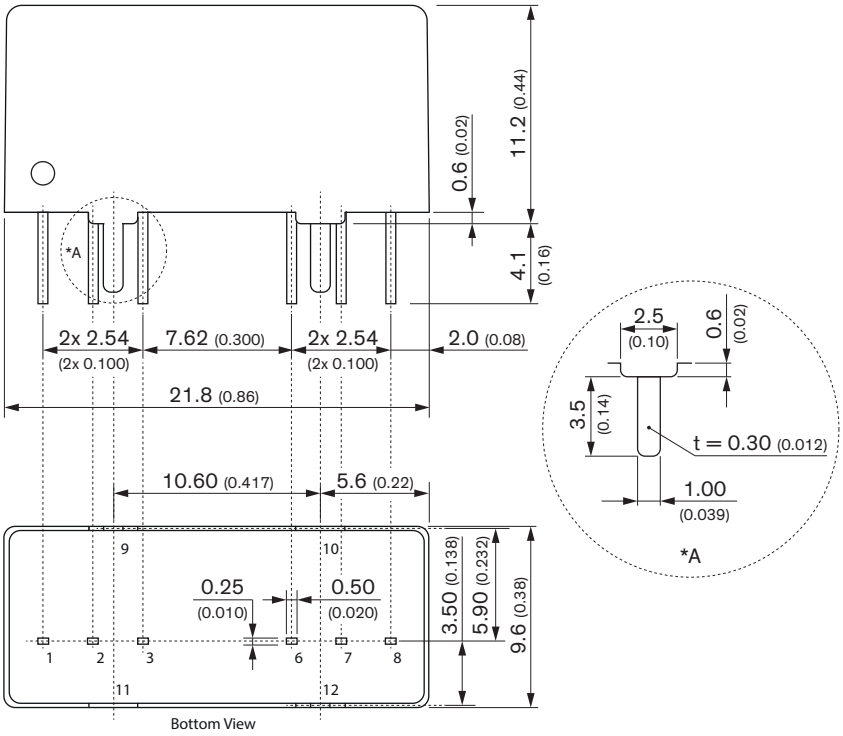
Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tmr9

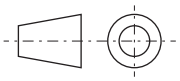
All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.

Outline Dimensions

Metal package (standard)



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



Pinout		
Pin	**Single Output**	**Dual Output**
1	–Vin (GND)	–Vin (GND)
2	+Vin (Vcc)	+Vin (Vcc)
3	Remote On/Off	Remote On/Off
6	+Vout	+Vout
7	–Vout	Common
8	NC	–Vout
9	Case*	Case*
10	Stand off	Stand off
11	Stand off	Stand off
12	Case*	Case*

NC: Not connected
*Case pins must not be connected to any circuit.

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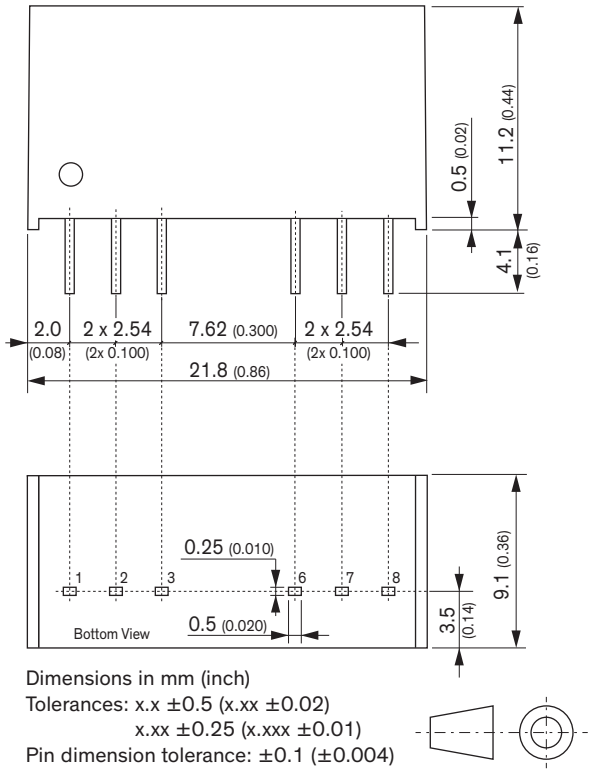
Plastic package (option)



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

Pinout		
Pin	**Single Output**	**Dual Output**
1	–Vin (GND)	–Vin (GND)
2	+Vin (Vcc)	+Vin (Vcc)
3	Remote On/Off	Remote On/Off
6	+Vout	+Vout
7	–Vout	Common
8	NC	–Vout

NC: Not connected