

### Features

- ◆ Wide 2:1 input voltage range
- ◆ Compact SIP-6 or SMD package
- ◆ Fully regulated outputs
- ◆ Cost optimised design
- ◆ No minimum load required
- ◆ Continuous short circuit protection
- ◆ Temperature range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- ◆ I/O isolation 1500 VDC
- ◆ Remote On/Off control (SMD)
- ◆ 3-year product warranty



The TMR-1 and TMR 1SM series are families of isolated 1 W dc-dc converter modules with regulated output, featuring wide 2:1 input voltage ranges. These products come in a compact SIP-6 or SMD package with small footprint occupying only 1.2 cm<sup>2</sup> (0.2 square inch) of board space.

An excellent efficiency allows  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  operation temperature. Further features include remote On/Off control (SMD-Version) and continuous short circuit protection. The compact dimensions and cost optimised design make this converters an ideal solution for applications in communication equipment, instrumentation and industrial electronics.

### Models

Order code SIP-package	Order code SMD-package	Input voltage range	Output voltage	Output current max.	Efficiency SIP typ.	Efficiency SMD typ.
TMR 1-0511	TMR 1-0511SM	4.5 – 9.0 VDC (5 VDC nominal)	5.0 VDC	200 mA	76 %	78 %
TMR 1-0512	TMR 1-0512SM		12 VDC	83 mA	77 %	79 %
TMR 1-0513	TMR 1-0513SM		15 VDC	67 mA	79 %	81 %
TMR 1-0515			24 VDC	42 mA	76 %	
TMR 1-0522	TMR 1-0522SM		$\pm 12$ VDC	$\pm 42$ mA	77 %	79 %
TMR 1-0523	TMR 1-0523SM		$\pm 15$ VDC	$\pm 33$ mA	78 %	80 %
TMR 1-1211	TMR 1-1211SM	9.0 – 18 VDC (12 VDC nominal)	5.0 VDC	200 mA	77 %	79 %
TMR 1-1212	TMR 1-1212SM		12 VDC	83 mA	77 %	79 %
TMR 1-1213	TMR 1-1213SM		15 VDC	67 mA	80 %	82 %
TMR 1-1215			24 VDC	42 mA	77 %	
TMR 1-1222	TMR 1-1222SM		$\pm 12$ VDC	$\pm 42$ mA	79 %	81 %
TMR 1-1223	TMR 1-1223SM		$\pm 15$ VDC	$\pm 33$ mA	78 %	80 %
TMR 1-2411	TMR 1-2411SM	18 – 36 VDC (24 VDC nominal)	5.0 VDC	200 mA	77 %	79 %
TMR 1-2412	TMR 1-2412SM		12 VDC	83 mA	80 %	82 %
TMR 1-2413	TMR 1-2413SM		15 VDC	67 mA	80 %	82 %
TMR 1-2415			24 VDC	42 mA	77 %	
TMR 1-2422	TMR 1-2422SM		$\pm 12$ VDC	$\pm 42$ mA	80 %	82 %
TMR 1-2423	TMR 1-2423SM		$\pm 15$ VDC	$\pm 33$ mA	80 %	82 %
TMR 1-4811	TMR 1-4811SM	36 – 75 VDC (48 VDC nominal)	5.0 VDC	200 mA	77 %	79 %
TMR 1-4812	TMR 1-4812SM		12 VDC	83 mA	78 %	80 %
TMR 1-4813	TMR 1-4813SM		15 VDC	67 mA	78 %	80 %
TMR 1-4815			24 VDC	42 mA	76 %	
TMR 1-4822	TMR 1-4822SM		$\pm 12$ VDC	$\pm 42$ mA	79 %	81 %
TMR 1-4823	TMR 1-4823SM		$\pm 15$ VDC	$\pm 33$ mA	79 %	81 %

### Input Specifications

Input current at no load (nominal input voltage)	5.0 V models: 40 mA typ. 12 V models: 20 mA typ. 24 V models: 10 mA typ. 48 V models: 7 mA typ.
Surge voltage (1 sec. max.)	5.0 V models: 15 V max. 12 V models: 25 V max. 24 V models: 50 V max. 48 V models: 100 V max.
Start-up voltage / under voltage lockout	5.0 V models: 4.5 VDC / 4 VDC or lower 12 V models: 9 VDC / 8.5 VDC or lower 24 V models: 18 VDC / 17 VDC or lower 48 V models: 36 VDC / 34 VDC or lower long term operation at undervoltage will damage the converter!
Conducted noise (input)	EN 55022 level A, FCC part 15, level A with external capacitor. see EMC consideration
Recommended input fuse (slow blow)	5 V models: 500 mA 12 V models: 250 mA 24 V models: 120 mA 48 V models: 60 mA

### Output Specifications

Voltage set accuracy	±1 % max.
Regulation	– Input variation $V_{in\ min.}$ to $V_{in\ max.}$ : 0.2 % max. – No load to full load Single & Dual output models: ±1.0 % max. – Load variation 10 – 90% Single output models: ±0.5 % max. Dual output models: ±0.8 % max.
Minimum load	no minimum load required
Temperature coefficient	0.02 %/K
Ripple and noise (20 MHz bandwidth)	SMD models: 30 mVp-p max. SIP models: 50 mVp-p max.
Transient response setting time (25% load step change)	250 µs typ. (PFM)
Transient response deviation	±5 % max.
Current limitation	>120 % of $I_{out\ max.}$
Over load protection (Foldback)	130 %
Short circuit protection	continuous, automatic recovery
Capacitive load	5 VDC models: 1'680 µF max. 12 VDC models: 820 µF max. 15 VDC models: 680 µF max. 24 VDC models: 470 µF max. ±12 VDC models: 470 µF max. (each output) ±15 VDC models: 330 µF max. (each output)

### General Specifications

Temperature ranges	– Operating SIP models: –40°C to +85°C with no derating SMD models: –40°C to +82°C with derating – Case temperature +105°C (SIP) / +95°C (SMD) max. – Storage –55°C to +125°C
Load derating	SMD models: 7.2 %/K above +75°C
Humidity (non condensing)	95 % rel. H max.
Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign)	>2.8 Mio h

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

**General Specifications**

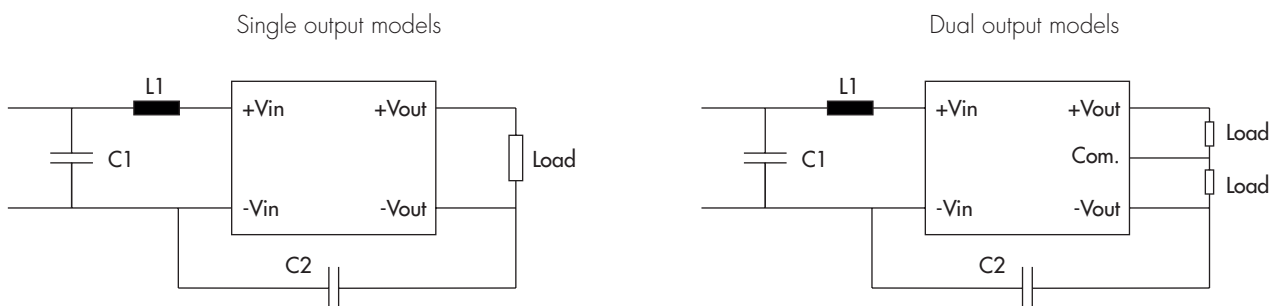
Isolation voltage (60 sec.)	- Input/Output	1'500 VDC
Isolation capacitance	- Input/Output	50 pF max.
Isolation resistance	- Input/Output (500 VDC)	>1 GOhm
Switching frequency		220 kHz (PFM)
Safety standards		CAN/CSA-C22.2 No 60950-1-07 Incl. AM1 (2011) ANSI/UL Std No 60950-1, 2nd Ed. Incl. AM1 (2011) IEC 60950-1:2005 (2nd Edition); +A1:2009 EN 60950-1:2006+A11:2009+A1:2010+A12:2011 <a href="http://www.tracopower.com/overview/tmr1">www.tracopower.com/overview/tmr1</a>
	- Certification documents	
Remote On/Off (SMD models only)	- On: - Off: - Off standby current: - Off control input current:	< 0.6 VDC or open circuit 2.7 to 15 VDC (ref. to -Vin) 2.5 mA max. 1 mA max.

**Physical Specifications**

Casing material		non-conductive plastic (UL94V-0 rated)
Potting material (for SIP-package models)		epoxy, (UL 94V-0 rated)
Weight		3.1 g (0.11oz) (SIP)/3.3 g (0.12oz) (SMD)
Soldering profile for SIP-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)
Washing Process (for SMD-package)		not recommended. Product non-hermetical.
Moisture sensivity 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/tmr1">www.tracopower.com/overview/tmr1</a> RoHS directive 2011/65/EU

**EMC Consideration**

Filter suggestion for to comply with EN55022 class A conducted noise emission



Input models	C1	C2	L1
5 VDC	4.7µF /50V, 1210 X7R	220pF /2 kV, 1808 X7R	4.7µH / 1.2 A, SR0302
12 VDC	4.7µF /50V, 1210 X7R		4.7µH / 1.2 A, SR0302
24 VDC SIP	4.7µF /50V, 1210 X7R		18µH / 0.58 A, SR0302
24 VDC SMD	4.7µF /50V, 1210 X7R		12µH / 0.75 A, SR0302
48 VDC SIP	4.7µF /100V 1210 X7R		18µH / 0.58A, SR0302
48 VDC SMD	2.2µF / 00V 1210 X7R		18µH / 0.58A, SR0302



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