

### 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 (balanced load): ±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)
Current limitation	>120 % of I <sub>out</sub> max.
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 – Case temperature – Storage	SIP models: –40°C to +85°C with no derating SMD models: –40°C to +82°C with derating +105°C (SIP) / +95°C (SMD) max. –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**

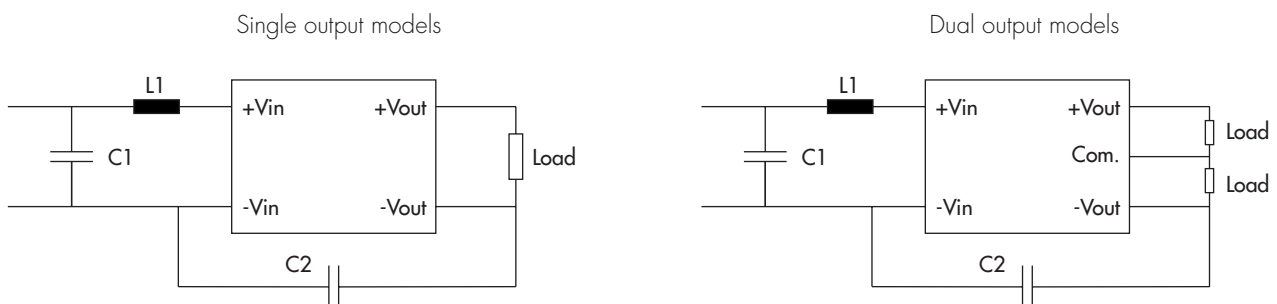
Isolation voltage (60 sec.)	- Input/Output	1'500 VDC
Isolation capacitance	- Input/Output	50 pF max.
Isolation resistance	- Input/Output (500 VDC)	>1 GOhm
Switching frequency		220 kHz (PFM)
Safety standards		UL 60950-1, IEC/EN 60950-1 IEC 60950-1:2005 (2nd Edition); Am 1:2009 EN 60950-1:2006+A11:2009+A1:2010+A12:2011
Safety approvals	- CB test certificate (IEC 60950-1)	<a href="http://www.tracopower.com/products/tmr1-cb.pdf">www.tracopower.com/products/tmr1-cb.pdf</a>
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		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)
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/products/reach-declaration.pdf">www.tracopower.com/products/reach-declaration.pdf</a> RoHS directive 2011/65/EU

**EMC Consideration**

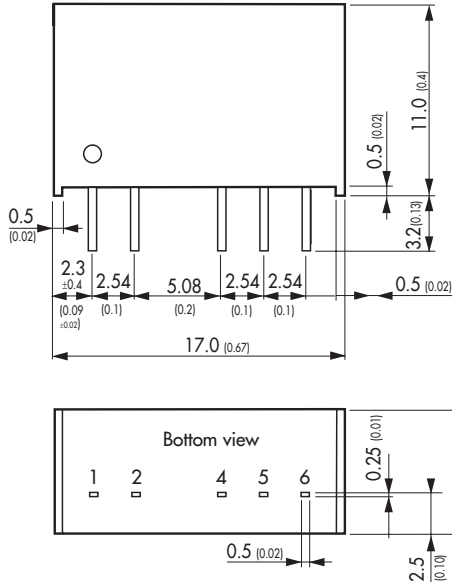
Filter suggestion for to comply with EN55022 class A conducted noise emission



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

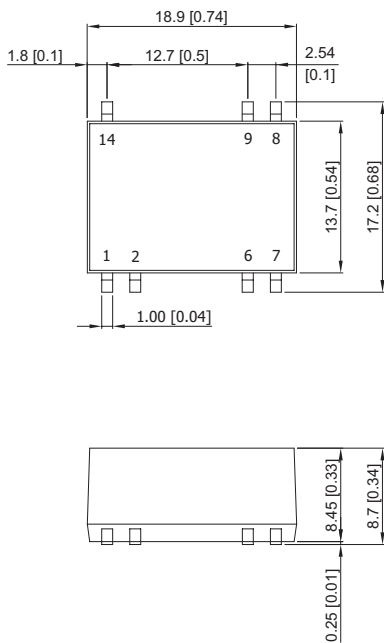
**Outline Dimensions mm (inches)**

**SIP-Package**



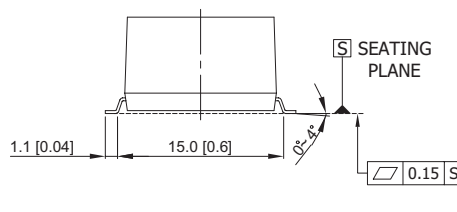
Pinout		
Pin	single output	dual output
1	-Vin (GND)	-Vin (GND)
2	+Vin (Vcc)	+Vin (Vcc)
4	+Vout	+Vout
5	No Pin	Common
6	-Vout	-Vout

**SMD-Package**



Pinout		
Pin	single output	dual output
1	-Vin (GND)	-Vin (GND)
2	Remote On/Off	Remote On/Off
6	ntc	Common
7	ntc	-Vout
8	+Vout	+Vout
9	-Vout	Common
14	+Vin	+Vin

ntc = not to connect to electrical circuit



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