

- Small SMD package with standard footprint
- I/O isolation voltage 1500 VDC
- Unregulated device
- Single and dual output models
- Input voltage 5, 12 and 24 VDC
- High efficiency up to 80%
- Operating Temperature range -40 to +85°C
- High accuracy of pin co-planarity
- Qualified for leadfree reflow solder process according IPC/JEDEC J-STD-020D
- Available in tape and reel package
- 3-year product warranty

With their small footprint these 2 Watt DC/DC converters are an ideal and economical solution for many applications where an isolated voltage is required. Typical applications are ground loop elimination, noise reduction, voltage isolation in digital interfaces and voltage conversion in distributed power systems. With a new package design these converters are qualified for the higher temperatures requested by lead-free reflow solder processes. For automated SMD production lines the devices can be supplied in standard tape and reel package.

Models				
Order code	Input voltage	Output voltage	Output current max.	Efficiency typ.
TES 2-0510H	<b>5 VDC ±10%</b> (5 VDC nominal)	3.3 VDC	500 mA	70 %
TES 2-0511H		5.0 VDC	400 mA	73 %
TES 2-0512H		12 VDC	165 mA	77 %
TES 2-0521H		±5 VDC	±200 mA	74 %
TES 2-0522H		±12 VDC	±83 mA	76 %
TES 2-0523H		±15 VDC	±66 mA	76 %
TES 2-1210H	<b>12 VDC ±10%</b> (12 VDC nominal)	3.3 VDC	500 mA	72 %
TES 2-1211H		5.0 VDC	400 mA	75 %
TES 2-1212H		12 VDC	165 mA	79 %
TES 2-1222H		±12 VDC	±83 mA	80 %
TES 2-1223H		±15 VDC	±66 mA	80 %
TES 2-2410H	<b>24 VDC ±10%</b> (24 VDC nominal)	3.3 VDC	500 mA	72 %
TES 2-2411H		5.0 VDC	400 mA	75 %
TES 2-2412H		12 VDC	165 mA	79 %
TES 2-2422H		±12 VDC	±83 mA	79 %
TES 2-2423H		±15 VDC	±66 mA	79 %

## Input Specifications

Input current no load / full load	5 Vin; 3.3 VDC model: 5 Vin; other models: 12 Vin; 3.3 VDC model: 12 Vin; other models: 24 Vin; 3.3 VDC model: 24 Vin; other models:	60 mA / 470 mA typ. 60 mA / 540 mA typ. 30 mA / 190 mA typ. 30 mA / 210 mA typ. 15 mA / 95 mA typ. 15 mA / 110 mA typ.
Surge voltage (1 sec. max.)	5 Vin models: 12 Vin models: 24 Vin models:	9 V max. 18 V max. 30 V max.
Under voltage shut down	12 Vin models: 24 Vin models: 48 Vin models:	8 VDC typ. 16 VDC typ. 34 VDC typ.
Reverse voltage protection		0.3 A max.
Input filter		internal capacitor

## Output Specifications

Voltage set accuracy		see graphs below
Voltage balance (dual output models, balanced load)		1 % max.
Regulation	– Input variation – Load variation 0 – 100 %	1.2 % / 1 % change Vin see graphs below
Minimum load		not required
Ripple and noise (20 MHz Bandwidth)		120 mVp-p max.
Temperature coefficient		±0.02 %/K typ.
Short circuit protection		limited 0.5s max.
Capacitive load	3.3 & 5.0 VDC models: 12 & ±5 VDC models: ±12 & ±15 VDC models:	47 µF max. 10 µF max. 4.7 µF max.

## General Specifications

Temperature ranges	– Operating (convection cooling 20LFM, 0,1m/s) – Case temperature – Storage temperature	–40°C to +92.5°C +95°C max. –40°C to +125°C
Derating (convection cooling)		4 %/K above 75°C
Humidity (non condensing)		95 % rel H max.
Reliability, calculated MTBF (MIL-HDBK-217F at +25°C, ground benign)		>2'000'000 h
Isolation voltage (60 sec.)		1'500 VDC
Isolation capacitance (100 kHz, 1V)		60 pF typ.
Isolation resistance (500 VDC)		>10 Gohm
Switching frequency		50 to 120 kHz typ. (depend on load)

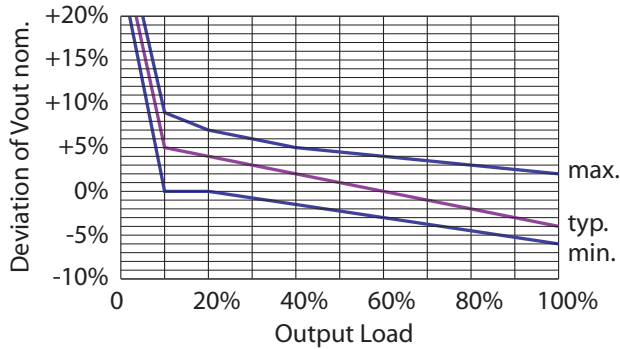
## Physical Specifications

Casing material		plastic (UL94V-0 rated)
Weight	single output models: dual output models:	1.5 g (0.05 oz) 2.2 g (0.08 oz)
Lead-free reflow solder process		as per J-STD-020BD.1 ( <a href="http://www.jedec.org">www.jedec.org</a> )
Moisture sensivity level (MSL)		level 2 as per J-STD-033B.1 (to find at: <a href="http://www.jedec.org">www.jedec.org</a> - free registration required)
Washing process		not recommended. Product non-hermetical
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

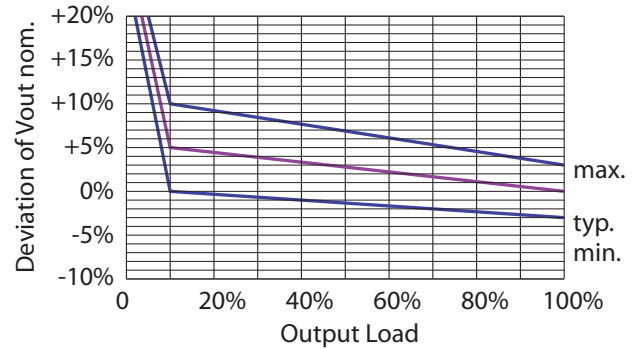
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

### Output voltage variation dependent on load (at nominal input voltage)

3.3 & 5.0 VDC models:



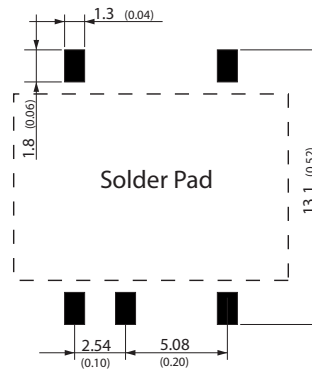
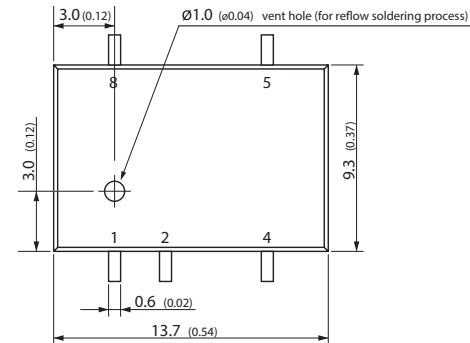
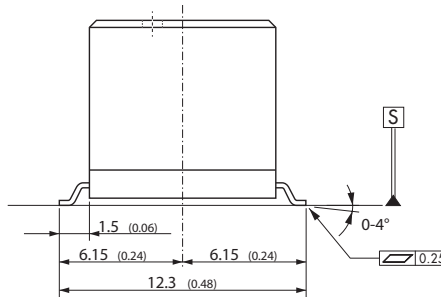
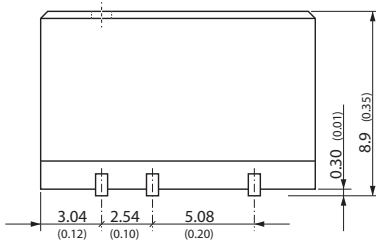
other models:



Supporting documents: [www.tracopower.com/overview/tes2h](http://www.tracopower.com/overview/tes2h)

### Outline Dimensions

Single Output Models



Pin-Out	
Pin	Single
1	-Vin (GND)
2	+Vin (Vcc)
4	-Vout
5	+Vout
8	No con.

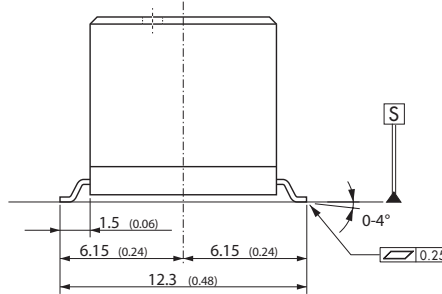
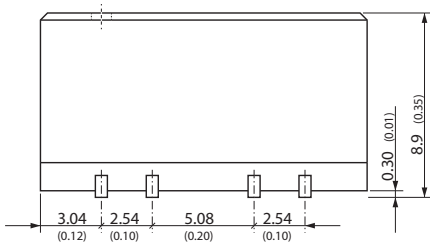
No con. = Pin to be isolated from circuit

Dimensions in [mm], ( ) = Inch  
Pin pitch tolerance: ±0.13 (0.005)  
Other tolerances: ±0.25 (0.001)

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

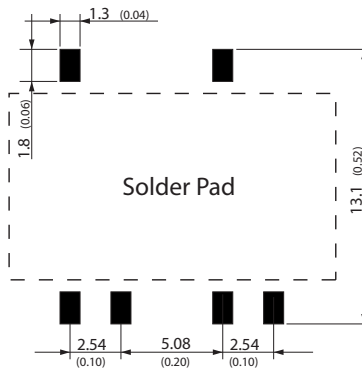
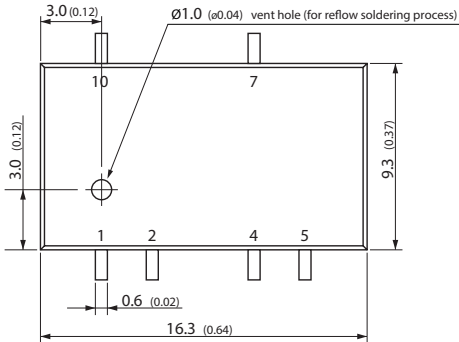
**Outline Dimensions**

Dual Output Models



Pin-Out	
Pin	Dual
1	-Vin (GND)
2	+Vin (Vcc)
4	Common
5	-Vout
7	+Vout
10	No con.

No con. = Pin to be isolated from circuit



Dimensions in [mm], ( ) = Inch  
 Pin pitch tolerance: ±0.13 (0.005)  
 Other tolerances: ±0.25 (0.001)