

FEATURES

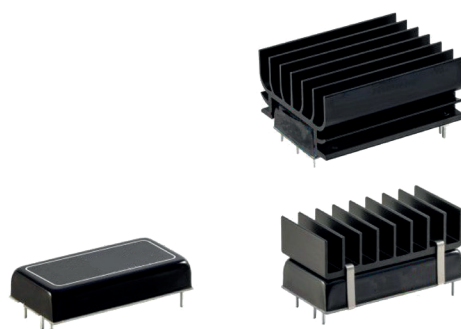
- 3000 Vdc Isolation
- Up to 60 Watts
- 4:1 Wide Input Range
- No Min. Load Required
- Remote ON/OFF
- Over Voltage and Over Current Protection
- Short Circuit and Over Load Protection

APPLICATIONS

- Railway Systems (EN50155, EN45545-2)
- Telecom
- Datacom
- Industrial Control
- Automation
- Measurement

GENERAL DESCRIPTION

The VTW60-Series is a family of 60 Watt single and dual DC/DC converters designed for application where isolated output is required from a distributed power system. These converters achieve different housing versions without compromising performance or field reliability. Models operate from an ultra wide 4:1 input bus voltage of 24, 48 and 110 Vdc offering output voltage levels of 3.3, 5, 12, 15, 24, 48, 53, ± 12 , ± 15 , and ± 24 Vdc. Typical applications are in telecom/datacom, industry control and railway systems for on board power distribution.



VTW60 -	24	05	S	-	N	HS
Series Name	Input Voltage (VDC)	Output Voltage (VDC)	Output Quantity		Remote On/Off Options	Assembly Options
	24: 9-36 48: 18-75 110: 36-160	3R3: 3.3 05: 5 5R1: 5.1 12: 12 15: 15 24: 24 48: 48 53: 53 12: ± 12 15: ± 15 24: ± 24	S: Single D: Dual		☐ : Positive logic N: Negative logic	☐ : None HS: with Heatsink; longitudinal fins HS1: with Heatsink; transversal fins, H=0.3" HS2: with Heatsink; transversal fins, H=0.5" HS3: with Heatsink; transversal fins, H=0.8"

SELECTION GUIDE

Model No.	nominal Input Voltage Range [Vdc]	nominal Output Voltage [Vdc]	Output Current @ full load [A]	Input Current @ No Load [mA]	Max. Capacitive Load [μF]	Efficiency typ. [%]
VTW60-243R3S	24 (9~36)	3.3	18.2	15	26000	88
VTW60-2405S		5	12	15	17000	91
VTW60-2412S		12	5	15	3000	93
VTW60-2415S		15	4	15	1900	93
VTW60-2424S		24	2.5	15	730	90.5
VTW60-2448S		48	1.25	20	190	91.5
VTW60-2453S		53	1.14	20	150	91.5
VTW60-2412D		±12	±2.5	20	±1500	90.5
VTW60-2415D		±15	±2	20	±940	90.5
VTW60-2424D		±24	±1.25	20	±370	91.5
VTW60-483R3S	48 (18~75)	3.3	18.2	10	26000	89
VTW60-4805S		5	12	10	17000	91.5
VTW60-4812S		12	5	10	3000	92.5
VTW60-4815S		15	4	10	1900	94
VTW60-4824S		24	2.5	10	730	91.5
VTW60-4848S		48	1.25	20	190	92
VTW60-4853S		53	1.14	20	150	92
VTW60-4812D		±12	±2.5	20	±1500	91.5
VTW60-4815D		±15	±2	20	±940	91.5
VTW60-4824D		±24	±1.25	20	±370	92
VTW60-1103R3S	110 (36~160)	3.3	18.2	10	26000	88
VTW60-11005S		5	12	10	17000	91
VTW60-11012S		12	5	10	3000	92
VTW60-11015S		15	4	10	1900	92
VTW60-11024S		24	2.5	10	730	90.5
VTW60-11048S		48	1.25	20	190	91
VTW60-11053S		53	1.14	20	150	91
VTW60-11012D		±12	±2.5	20	±1500	90.5
VTW60-11015D		±15	±2	20	±940	90.5
VTW60-11024D		±24	±1.25	20	±370	91

INPUT SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit	
Operating input voltage range	24 Vin (nom)		9	24	36	Vdc	
	48 Vin (nom)		18	48	75		
	110 Vin (nom)		36	110	160		
Start up voltage	24 Vin (nom)		-	-	9	Vdc	
	48 Vin (nom)		-	-	18		
	110 Vin (nom)		-	-	36		
Shutdown voltage	24 Vin (nom)		7	8	8.8	Vdc	
	48 Vin (nom)		15	16	17.5		
	110 Vin (nom)		32	34	35.8		
Start up time	Constant resistive load	Power up	-	30	60	ms	
		Remote ON/OFF					
Input surge voltage	1s, max.	24 Vin (nom)	-	-	50	Vdc	
		48 Vin (nom)	-	-	100		
		110 Vin (nom)	-	-	200		
Input Filter	-		Pi type				
Remote ON/OFF	Referred to -Vin pin	Positive logic (Standard)	DC-DC ON	Open or 3 ~ 12 Vdc			
			DC-DC OFF	Short or 0 ~ 1.2 Vdc			
		Negative logic (Option)	DC-DC ON	Short or 0 ~ 1.2 Vdc			
			DC-DC OFF	Open or 3 ~ 12 Vdc			
		Input current of Ctrl pin		-0.5	-	0.5	mA
		Remote off input current		-	3	-	mA

FUSE CONSIDERATION

This power modules is not internally fused. An input line fuse must always be used.

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.

To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below:

Model	Fuse Rating [A]	Fuse Type
24 Vin-Models	10	Fast-Acting
48 Vin-Models	6.3	Slow-Blow
110 Vin-Models	3.15	Slow-Blow

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

OUTPUT SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit
Voltage accuracy	-		-1.0	-	+1.0	%
Line regulation	Low Line to high line @ full load		-0.2	-	+0.2	%
Load regulation	No load to full load	Single	-0.5	-	+0.5	%
		Dual	-1.0	-	+1.0	%
Cross regulation	Asymmetrical load 25%/100% FL	Dual	-5.0	-	5.0	%
Voltage adjustability	Single output	Others	-10	-	+10	%
		15Vout, 24Vout	-10	-	+20	%
Remote sense	% of Vout (nom) if remote sense is not being used, Sense pins should be connected to corresponding polarity OUTPUT pins.		-	-	10	%
Ripple and noise	Measured by 20MHz band-width with a 1 μ F/100 V X7R MLCC	3.3Vout, 5Vout	-	75	100	mVp-p
		12Vout, 15Vout		100	125	
		24Vout		150	200	
		48Vout, 53Vout	-	300	350	
Temperature coefficient	-		-0.02	-	+0.02	%/°C
Transient response recovery time	25% load step change		-	250	-	μ s
Over load protection	% of Iout rated; Hiccup mode		-	150	-	%
Short circuit protection	-		continuous, automatic recovery			

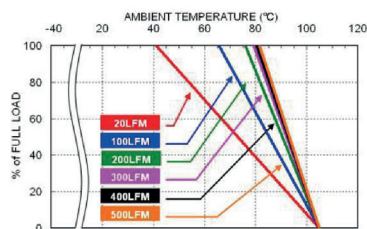
ENVIRONMENTAL SPECIFICATIONS

Item	Conditions	Min.	Typ.	Max.	Unit
Operating ambient temperature	with derating	-40	-	+105	°C
Maximum case temperature	-	-	-	+105	°C
Over temperature protection	-	-	115	-	°C
Storage temperature range		-55	-	+125	°C
Thermal impedance	Module without assembly option	-	10.8	-	°C/W
	Heat-sink option HS1	-	8.3	-	
	Heat-sink option HS2	-	7.0	-	
	Heat-sink option HS3	-	5.7	-	
	Heat-sink option HS	-	5.9	-	
Thermal shock	-	MIL-STD-810F			
Shock	-	EN61373, MIL-STD-810F			
Vibration	-	EN61373, MIL-STD-810F			
Relative humidity	-	5% to 95% RH			

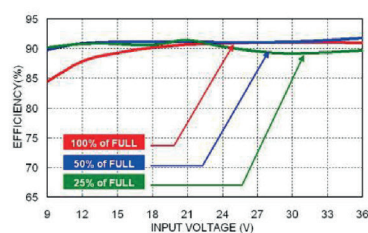
GENERAL SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	Input to Output	3000	-	-	Vdc
		Input to case	2250	-	-	
Isolation resistance	500 Vdc		1			GΩ
Isolation capacitance	-		-	-	1500	pF
Switching frequency	-		200	250	275	kHz
Safety standards	-		IEC / UL / EN62368-1 (designed to meet)			
Approval standards	-		EN50155, EN45545-2 (designed to meet)			
Case material			Copper			
Base material			FR4 PCB			
Potting material	-		Silicone (UL94 V-0)			
Weight	Module stand alone		34g (1.2oz)			
MTBF	MIL-HDBK-217F, Full load		7.245 x 10 ⁵ hrs			

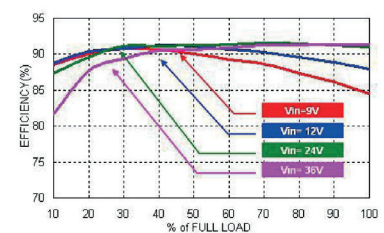
CHARACTERISTIC CURVE



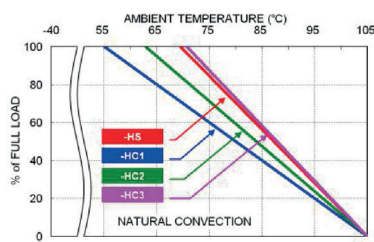
VTW60-2405S Derating Curve



VTW60-2405S Efficiency vs. Input Voltage



VTW60-2405S Efficiency vs. Output Load



VTW60-2405S Derating Curve
with Heat-sink

EMC SPECIFICATIONS

Item	Conditions		Level
EMI	EN55032, EN50121-3-2	with external components	Class A, Class B
EMS	EN55035, EN50121-3-2		
ESD	EN61000-4-2	Air $\pm 8\text{kV}$ and Contact $\pm 6\text{kV}$	Perf. Criteria A
Radiated Immunity	EN61000-4-3	20 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	$\pm 2\text{ kV}$	Perf. Criteria A
	24 Vin	With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220 $\mu\text{F}/100\text{V}$) and a TVS (and a TVS (SMDJ58A, 58V, 3000Watt peak pulse power) in parallel	
	48 Vin	With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220 $\mu\text{F}/100\text{V}$) and a TVS (and a TVS (SMDJ58A, 120V, 3000Watt peak pulse power) in parallel	
	110 Vin	With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KXJ series, 150 $\mu\text{F}/200\text{V}$) and a TVS (and a TVS (SMDJ58A, 170V, 3000Watt peak pulse power) in parallel	
Surge	EN61000-4-5	$\pm 2\text{kV}$	Perf. Criteria A
	24 Vin	With 2 pcs of aluminum electrolytic capacitor or Nippon chemi-con KY series, 220 $\mu\text{F}/100\text{V}$) and a TVS (SMDJ58A, 58V, 3000Watt peak pulse power) in parallel	
	48Vin	With 2 pcs of aluminum electrolytic capacitor or Nippon chemi-con KY series, 220 $\mu\text{F}/100\text{V}$) and a TVS (SMDJ120A, 120V, 3000Watt peak pulse power) in parallel	
	110 Vin	With 2 pcs of aluminum electrolytic capacitor or (Nippon chemi-con KXJ series, 150 $\mu\text{F}/200\text{V}$) and a TVS (SMDJ 170 A, 170 V, 3000Watt peak pulse power) in parallel	
Conducted immunity	EN61000-4-6	10 Vrms	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second	Perf. Criteria A

Note:

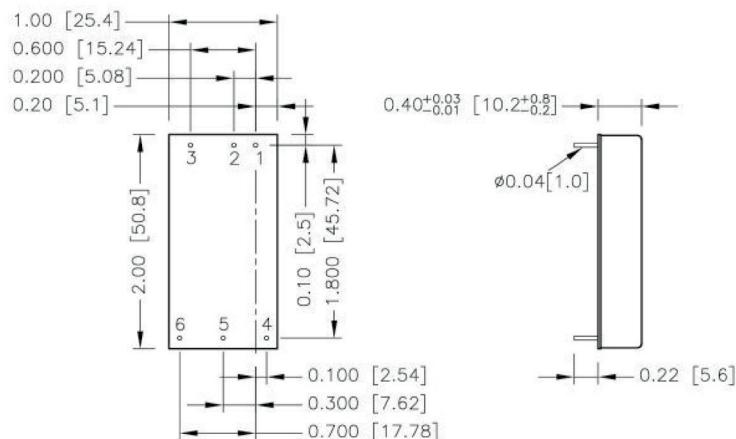
Input source impedance: The power module will operate as specifications without external components, assuming that the source voltage has a very low impedance and reasonable input voltage regulation. Highly inductive source impedances can affect the stability of the power module.

Since real-world voltage source has finite impedance, performance can be improved by adding external filter capacitor. The 110Vin model recommended 47 $\mu\text{F}/200\text{V}$, Ruby-con BXF series.

CAUTION: This power module is not internally fused. An input line fuse must always be used.

MECHANICAL DRAWING

Standard, -HS1, -HS2, -HS3

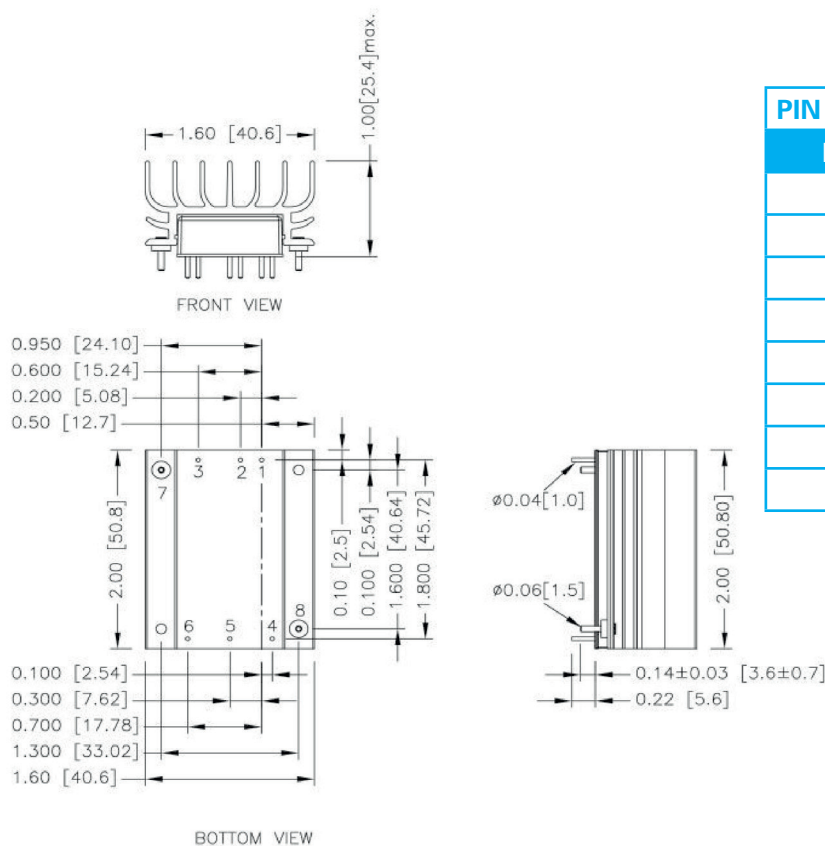


BOTTOM VIEW

PIN CONNECTION

PIN	Single	Dual
1	+ Vin	+ Vin
2	- Vin	- Vin
3	Ctrl	Ctrl
4	+ Vout	+ Vout
5	- Vout	Com
6	Trim	- Vout

-HS



BOTTOM VIEW

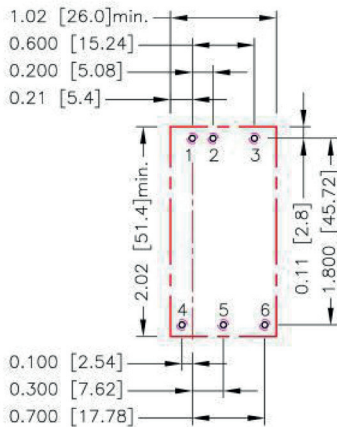
PIN CONNECTION

PIN	Single	Dual
1	+ Vin	+ Vin
2	- Vin	- Vin
3	Ctrl	Ctrl
4	+ Vout	+ Vout
5	- Vout	Com
6	Trim	- Vout
7	Heat-Sink	Heat-Sink
8	Heat-Sink	Heat-Sink

- All dimensions in inch [mm]
Tolerance: x.xx $\pm$ 0.02 [x.x $\pm$ 0.5]
x.xxx $\pm$ 0.01 [x.x $\pm$ 0.25]
- Pin dimension tolerance $\pm$ 0.004 [$\pm$ 0.10]

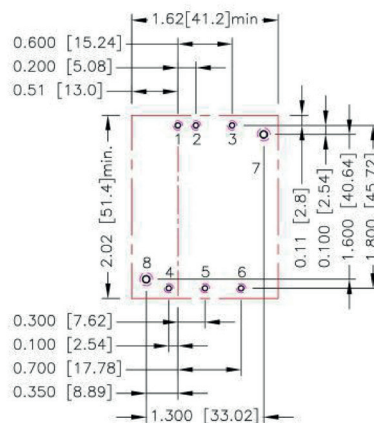
RECOMMENDED PAD LAYOUT

Standard



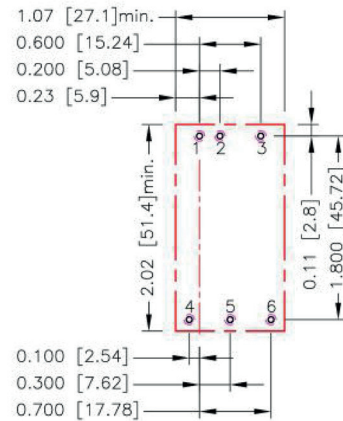
All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3.4.5.6: diameter 0.051[1.30]
Top view pad 1.2.3.4.5.6: diameter 0.064[1.63]
Bottom view pad 1.2.3.4.5.6: diameter 0.102[2.60]

-HS



All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3.4.5.6: diameter 0.051[1.30]
Through hole 7.8: diameter 0.071[1.80]
Top view pad 1.2.3.4.5.6: diameter 0.064[1.63]
Top view pad 7.8: diameter 0.089[2.25]
Bottom view pad 1.2.3.4.5.6: diameter 0.102[2.60]
Bottom view pad 7.8: diameter 0.142[3.60]

-HS1, -HS2, -HS3



All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3.4.5.6: diameter 0.051[1.30]
Top view pad 1.2.3.4.5.6: diameter 0.064[1.63]
Bottom view pad 1.2.3.4.5.6: diameter 0.102[2.60]

THERMAL CONSIDERATIONS

The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the middle point on top of the module.

The temperature at this location should not exceed „Maximum case temperature“

When operating, adequate cooling must be provided to maintain the test point temperature at or below „Maximum case temperature“

You can limit this Temperature to a lower value for extremely high reliability.

Thermal test condition with vertical direction by natural convection (20LFM).

OUTPUT VOLTAGE ADJUSTMENT

It allows to increase or decrease the output voltage of the module.

This is accomplished by connecting an external resistor between the Trim pin and either the +Vout or -Vout pins.

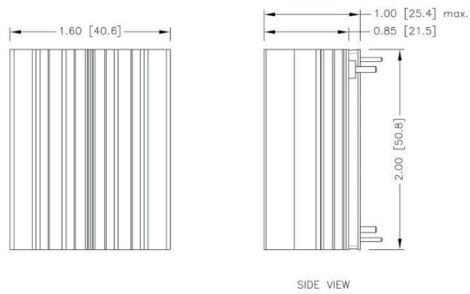
With an external resistor between the Trim and -Vout pin, the output voltage increases.

With an external resistor between the Trim and +Vout pin, the output voltage decreases.

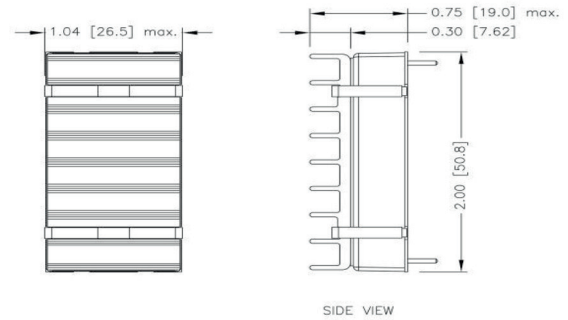
The external Trim resistor needs to be at least 1/8 W of rated power.

HEAT-SINK OPTIONS

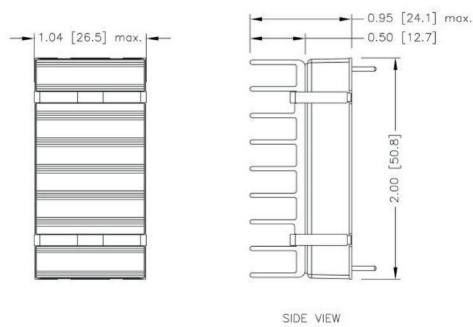
-HS Option



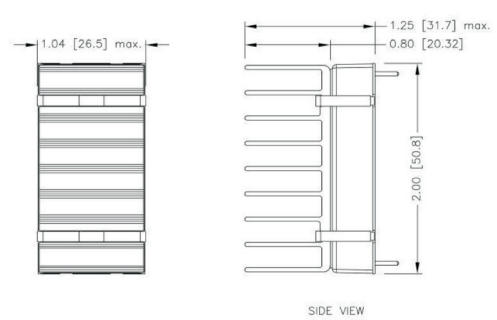
-HS1 Option



-HS2 Option



-HS3 Option



All dimensions in inch [mm]
Tolerance: x.xx±0.02 [x.x±0.5]
x.xx±0.01 [x.x±0.25]

Specifications can be changed without prior notice. Products are not intended for and must not be used in life support systems, human implantation, nuclear facilities or systems or any other application where product failure or malfunction of the component could lead to loss of life or catastrophic property damage.