

FEATURES

- 1600 Vdc Isolation
- Up to 10 Watts
- High Efficiency up to 91%
- 2:1 Wide Input Range
- Six-Sided Continuous Shield
- No Min. Load Required
- Remote ON/OFF
- Over Voltage and Over Current Protection
- Short Circuit and Under Voltage Protection

APPLICATIONS

- Telecom
- Datacom
- Industrial Control
- Automation
- Measurement

GENERAL DESCRIPTION

The VT10Q series is a family of 10 Watt single and dual output DC-DC converters. These converters combine a six-side shielded nickel-coated copper package in a 1 x 1 x 0.4 compatible case with high performance features such as 1600 Vdc input/output isolation voltage, continuous short circuit protection with automatic restart and tight line and load regulation.

Models operate from a 2:1 input bus voltage of 12, 24 and 48Vdc offering output voltage levels of 3.3, 5, 12, 15, 24, ± 5 , ± 12 and ± 15 Vdc. Cooling is by free-air convection, or optional by heat sink.



PART NUMBER STRUCTUR

VT10Q	- 24	05	S	P	-HC
Series Name	Input Voltage (VDC)	Output Voltage (VDC)	Output Quantity	Logical & pin Options	Assembly Options
	12: 9-18 24: 18-36 48: 36-75	3R3: 3.3 05: 5 12: 12 15: 15 24: 24 05: ± 5 12: ± 12 15: ± 15	S: Single D: Dual	<input type="checkbox"/> : Negative logic P: Positive logic B: without Ctrl pin C: Negative logic without Trim pin D: without Ctrl & Trim pin E: Positive logic without Trim pin	<input type="checkbox"/> : None -HC: Heatsink with Clamp

SELECTION GUIDE

Model No.	nominal Input Voltage Range [Vdc]	nominal Output Voltage [Vdc]	Output Current		Input Current @ No Load [mA]	Max. Capacitive Load [μ F]	Efficiency typ. [%]
			min.	max			
VT10Q-123R3S	12 (9~18)	3.3	0	3000	10	3500	83
VT10Q-1205S		5	0	2000	10	2500	86
VT10Q-1212S		12	0	830	10	430	89
VT10Q-1215S		15	0	670	10	360	90
VT10Q-1224S		24	0	416	10	125	91
VT10Q-1205D		\pm 5	0	\pm 1000	10	\pm 1440	86
VT10Q-1212D		\pm 12	0	\pm 416	10	\pm 250	89
VT10Q-1215D		\pm 15	0	\pm 333	10	\pm 180	90
VT10Q-243R3S		24 (18~36)	3.3	0	3000	6	3500
VT10Q-2405S	5		0	2000	6	2500	86
VT10Q-2412S	12		0	830	6	430	91
VT10Q-2415S	15		0	670	6	360	90
VT10Q-2424S	24		0	416	6	125	91
VT10Q-2405D	\pm 5		0	\pm 1000	6	\pm 1440	86
VT10Q-2412D	\pm 12		0	\pm 416	6	\pm 250	90
VT10Q-2415D	\pm 15		0	\pm 333	6	\pm 180	90
VT10Q-483R3S	48 (36~75)		3.3	0	3000	4	3500
VT10Q-4805S		5	0	2000	4	2500	87
VT10Q-4812S		12	0	830	4	430	90
VT10Q-4815S		15	0	670	4	360	90
VT10Q-4824S		24	0	416	4	125	91
VT10Q-4805D		\pm 5	0	\pm 1000	4	\pm 1440	87
VT10Q-4812D		\pm 12	0	\pm 416	4	\pm 250	91
VT10Q-4815D		\pm 15	0	\pm 333	4	\pm 180	90

INPUT SPECIFICATIONS						
Item	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range	12 Vin (nom)		9	12	18	Vdc
	24 Vin (nom)		18	24	36	
	48 Vin (nom)		36	48	75	
Start up voltage	12 Vin (nom)		-	-	9	Vdc
	24 Vin (nom)		-	-	18	
	48 Vin (nom)		-	-	36	
Shutdown voltage	12 Vin (nom)		7.5	8	8.8	Vdc
	24 Vin (nom)		15.5	16	17.5	
	48 Vin (nom)		32.5	33	35.5	
Start up time	Constant resistive load	Power up	-	-	30	ms
		Remote ON/OFF				
Input surge voltage	1s, max.	12 Vin (nom)	-	-	25	Vdc
		24 Vin (nom)	-	-	50	
		48 Vin (nom)	-	-	100	
Remote ON/OFF	Referred to -Vin pin	Positive logic (Option)	DC-DC ON	Open or 3 ~ 15 Vdc		
			DC-DC OFF	Short or 0 ~ 1.2 Vdc		
		Negative logic (Standard)	DC-DC ON	Short or 0 ~ 1.2 Vdc		
			DC-DC OFF	Open or 3 ~ 15 Vdc		
		Input current of Ctrl pin	-0.5	-	+1.0	mA
Remote off input current	-	2.5	-	mA		

OUTPUT SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit
Output Power	Output voltage trimmed up 10%		-	-	11	W
	Output voltage trimmed up 20%		-	-	12	W
Voltage accuracy	-		-1.0	-	+1.0	%
Line regulation	Low Line to high line @ full load	Single	-0.2	-	+0.2	%
		Dual	-0.5	-	+0.5	
Load regulation	No load to full load	Single	-0.2	-	+0.2	%
		Dual	-1.0	-	+1.0	
	10% load to 90% load	Single	-0.1	-	+0.1	
		Dual	-0.8	-	+0.8	
Cross regulation	Asymmetrical load 25%/100% FL	Dual	-5.0	-	5.0	%
Voltage adjustability	Single output	3.3 & 12 Vout	-10	-	+10	%
		others	-10	-	+20	
Ripple and noise	Measured by 20MHz bandwidth with a 10µF/25 V X7R 1206 MLCC	3.3 & 5 Vout	-	40	-	mVp-p
		12 & 15 Vout	-	60	-	
	with a 1µF/50 V X7R 1206 MLCC	24 Vout	-	60	-	
Temperature coefficient	-		-0.02	-	+0.02	%/°C
Transient response recovery time	25% load step change		-	250	-	µs
Over voltage protection	-	3.3 Vout	3.7	-	5.4	Vdc
	-	5 Vout	6.3	-	7.4	
	-	12 Vout	13.5	-	19.6	
	-	15 Vout	18.3	-	22.0	
	-	24 Vout	29.1	-	32.5	
Over load protection	% of lout rated; Hiccup mode		-	150	-	%
Short circuit protection	-		continuous, automatic recovery			

ENVIRONMENTAL SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit
Operating ambient temperature	without derating		-40	-	+78	°C
	with derating		+78	-	+105	
Maximum case temperature	-		-	-	+105	°C
Storage temperature range	-		-55	-	+125	°C
Thermal impedance	without Heat-sink		-	16.18	-	°C/W
	with Heat-sink option -HC		-	15.13	-	
Thermal shock	-		MIL-STD-810F			
Vibration	-		MIL-STD-810F			
Relative humidity	-		5% to 95% RH			

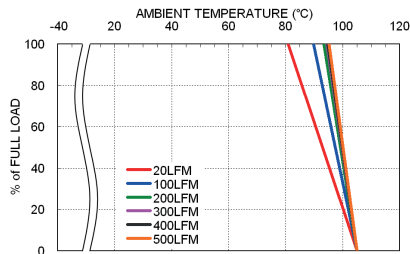
GENERAL SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	Input to Output	1600	-	-	Vdc
		Input(Output) to case	1000	-	-	
Isolation resistance	500 Vdc		1			GΩ
Isolation capacitance	-		-	-	1500	pF
Switching frequency	-		297	330	363	kHz
Safety standards	-		IEC / UL / EN62368-1 (designed to meet)			
Case material			Copper			
Base material			FR4 PCB			
Potting material	-		Silicone (UL94 V-0)			
Weight	Module stand alone		16.5g (0.58oz)			
MTBF	MIL-HDBK-217F, Full load		3.308 x 10 ⁶ hrs			

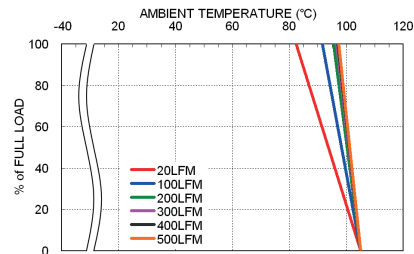
EMC SPECIFICATIONS

Item	Conditions		Level
EMI	EN55032	without external components	Class A
		with external components	Class B
EMS	EN55035		
ESD	EN61000-4-2	Air ±8kV and Contact ±6kV	Perf. Criteria A
Radiated Immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	±2 kV	Perf. Criteria A
		With an external input filter capacitor (Nippon chemi-con KY series, 220 µF/100V)	
Surge	EN61000-4-5	±1kV	Perf. Criteria A
		With an external input filter capacitor (Nippon chemi-con KY series, 220 µF/100V)	
Conducted immunity	EN61000-4-6	3 Vrms	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second	Perf. Criteria A

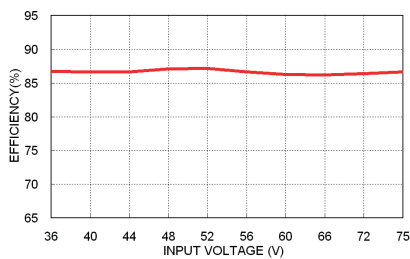
CHARACTERISTIC CURVE



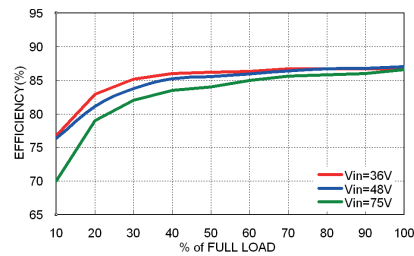
VT10Q-4805S Derating Curve



VT10Q-4805S Derating Curve with Heat-sink



VT10Q-4805S Efficiency vs. Input Voltage



VT10Q-4805S Efficiency vs. Output Voltage

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.

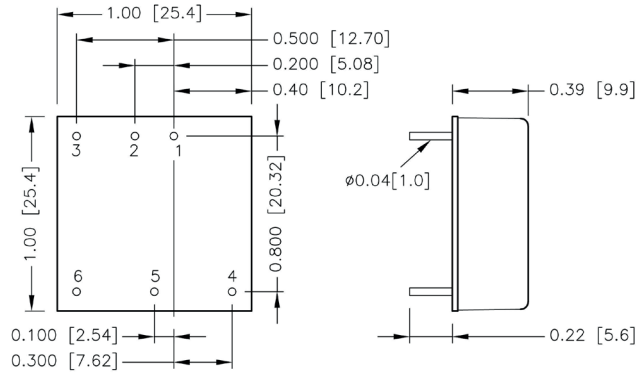
The input line fuse suggest as below:

Model	Fuse Rating [A]	Fuse Type
12 Vin-Models	2	Slow-Blow
24 Vin-Models	1.25	Slow-Blow
48 Vin-Models	0.63	Slow-Blow

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

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

MECHANICAL DRAWING



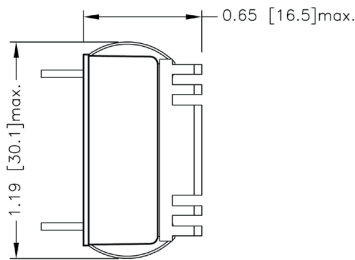
BOTTOM VIEW

PIN CONNECTION

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

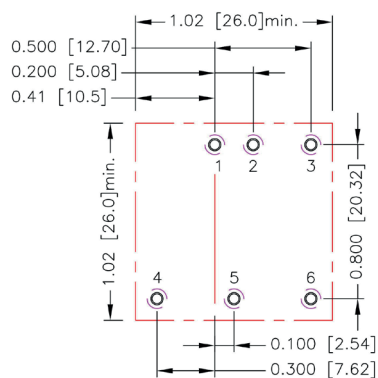
- All dimensions in inch [mm]
Tolerance: $x.xx \pm 0.02$ [$x.x \pm 0.5$]
 $x.xxx \pm 0.01$ [$x.x \pm 0.25$]
- Pin dimension tolerance ± 0.004 [± 0.10]

HEAT SINK OPTION „-HC“ (Heat Sink with Clamps)

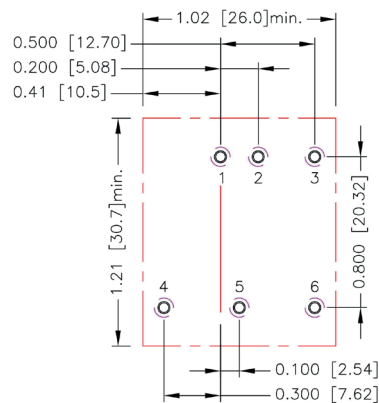


RECOMMENDED PAD LAYOUT

Standard



-HC



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

Output voltage set point adjustment allows the user 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 1/16 W of rated power.

Trim Up Equation

$$R_U = \left[\frac{G \times L}{(V_{o,up} - L - K)} - H \right] \Omega$$

Trim Down Equation

$$R_D = \left[\frac{(V_{o,down} - L) \times G}{(V_o - V_{o,down})} - H \right] \Omega$$

Trim constants

Model	G	H	K	L
VT10Q-xx3R3S	5110	2050	0.8	2.5
VT10Q-xx05S	5110	2050	2.5	2.5
VT10Q-xx12S	10000	5110	9.5	2.5
VT10Q-xx15S	10000	5110	12.5	2.5
VT10Q-xx24S	56000	13000	21.5	2.5

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.